DECEMBER 11, 1961

American Machinist / Metalworking Manufacturing

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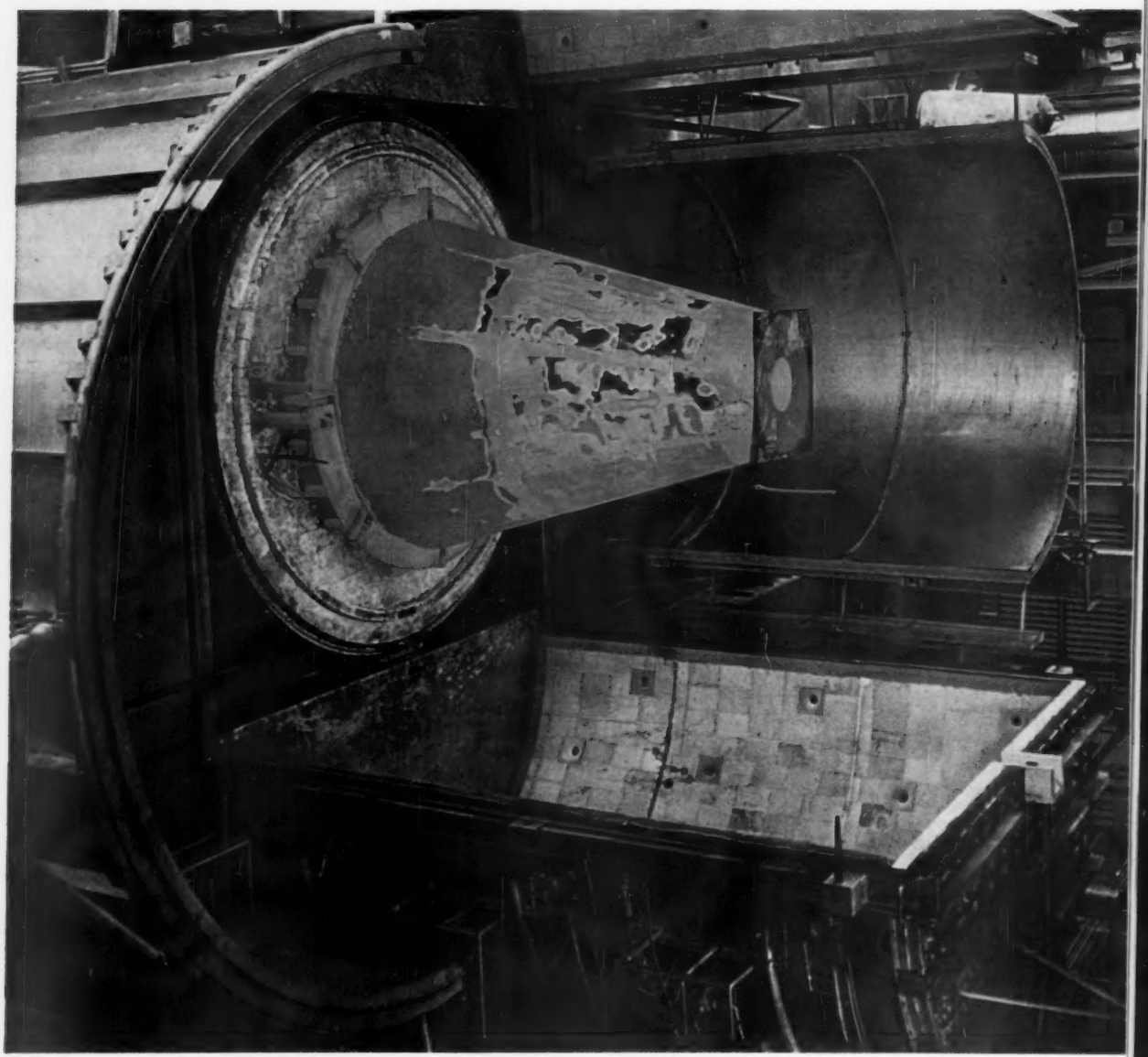


Clam-shell furnace at Rocketdyne brazes at 2300 F— see page 1

- **Where form grinding pays off,** p101
- **How to cut screw-machine rejects,** p112
- **Welding titanium in the open,** p116

REJUVENATING RED-HEADS

How to make an old Boringhead or Wheelhead Good as New

by Arthur Walsh
Manager, Parts Sales
The Heald Machine Company

There's only *one* way to make an old Red-Head good as new. Return it to its maker!

This statement is neither facetious nor exaggerated. Let's look at the facts.

A precision machine tool spindle, although basically simple in design, is one of the most carefully engineered and meticulously manufactured components of the entire machine. This is particularly true of Heald Red-Head Boringheads and Wheelheads. It has to be that way, for on the *spindle* depends the performance of the machine and the reputation of the Company.

When a Red-Head Wheelhead or Boringhead needs reconditioning, and you want it restored to original Red-Head precision, ship it back to us here in Worcester. For nobody knows as much about a product as the company which made it. And certainly no one else has so much at stake on its performance!

When a head comes back here we give it the full Red-Head treatment. This includes as *much* or as *little* as needs to be done to make it as good as new. Any or all of the following items may be replaced or reworked, depending on their condition – body, spindle, caps, slingers, pulleys, spacers, spring cages, bearings and miscellaneous parts. Only the finest Ultra-precision bearings made to Heald specifications are used – precision matched for exactly the right internal clearances, fits and preloads.

After final inspection and reassembly, every rebuilt Red-Head is run continuously on the test jack for eight hours to check for temperature rise, noise level and vibration. A head that passes all of our inspections and tests is in every respect as good as new.

The cost depends on the amount of work done and the parts reworked or replaced. But in all cases you get a head that carries the original Heald guarantee, at far less than the cost of a new head.

Several of our customers have adopted a policy of regularly-scheduled head rebuilding on a preventive-maintenance basis. This has worked out very well, as it keeps the amount of repairs to the minimum, assures fast return of the rebuilt heads and substantially reduces rebuilding costs.

It pays to come to Heald for all your Red-Head repairs.

Anti-Friction bearings for Heald Red-Heads are carefully selected and thoroughly inspected before assembly into any Red-Head – the same rigid specifications must be met for bearings to be used in either **new** or **rebuilt** heads.

It Pays to come to Heald

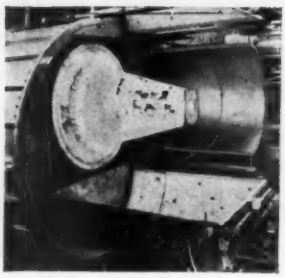
THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

CIRCLE 251 READER SERVICE CARD

COVER:

Clam-shell brazing furnace at Rocketdyne Div of North American Aviation was built by Pacific Scientific Corp. It has 68 radiant burners, uses 22,000 cu ft of gas per hr.



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TURN PAGE FOR METALWORKING REPORT ——►

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

MATERIALS . . . Coiled cobalt strip, 99.9% pure, is now available from a Canadian supplier. Previously, lack of ductility made it next to impossible to coil this material. Now the strip is rolled directly from pure cobalt powder, then **heat treated to yield the desired mechanical properties.** This is possible because cobalt has two crystal forms: close-packed hexagonal and face-centered cubic. **Because the heat treatment can determine the proportions of these two forms, it determines such properties as ductility.** One possible application: magnetic tape for computers.

CUTTING . . . Electrolytic grinding doesn't induce measurable residual stress if wheel downfeed is kept below 0.002 in. Slightly higher downfeeds—0.003 and 0.0045 in.—produce small compressive or tensile stresses well below the yield strength of the workpiece. These findings, results of tests on 1020 steel conducted by J Frisch and R R Cole of the University of California (and reported at the ASME Winter Annual Meeting in New York), are significant, for it has been established that EDM can induce residual stress, and the same might have been thought for electrolytic grinding.

FORMING . . . Titanium skin-type panels are being formed at temperatures to 1400 F at McDonnell Aircraft (St Louis) on die blocks made of Glasrock, a ceramic made by Glasrock Products Inc (Atlanta). **Heating elements are cast into dies, eliminating furnace heating.** There is no significant warpage, softening or cracking of panels.

FORMING . . . Magneform is now on the market. The magnetic forming machine, now being marketed by The General Atomic Div of General Dynamics, **can be leased for approximately $6,000 a year,** as previously reported (AM/MM—Oct 30 '61, p3). For details on the commercial machine, see page 139.

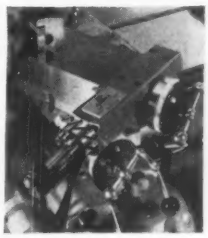
FINISHING . . . First Detroit-area application of Minnesota Mining and Manufacturing's mechanical plating system, at Robin Products Co (Warren, Mich), **may start a trend in the automotive industry.** Mechanical zinc plating on small clips, washers, and fasteners avoids hydrogen embrittlement, **requires only 1/3 to ½ the capital investment, and** reduces operator skill required. Process uses tumble-plating technique, glass beads as tumbling media, powdered plating metal, and a 3M "promoter" chemical. Stock is first copper-flashed, then it is tumbled.

CLEANING . . . A descaling process that works directly on the scale (rather than by etching the base metal to cause the scale to fall off) has been developed by Rohr Aircraft (Chula Vista, Calif) **for stainless steel and alloys such as Hastelloy X and Rene 41.** Called RW 77, it is claimed to work without causing intergranular attack or etching. The solution, **which can be used at room temperatures without producing dangerous or noxious fumes,** requires no special remodeling or construction of facilities.

COATING . . . Pure silver can now be applied directly to aluminum by a powder-fed gas torch developed by Powder Weld Inc (Brooklyn). Because the **silver is applied in molten state,** it forms an anodic bond with the aluminum, **eliminating any oxide layer between the two metals.** A nitrogen or hydrogen gas shield protects molten silver from atmospheric contamination. Also, there is a **significant silver saving, because it can be applied to precisely those contact areas where it is needed.** Hose doesn't clog, as gas pressure in powder container automatically clears hose when torch is shut off.

FORMING . . . Peak pressure requirements for coining lead are reduced 30 to 35% by vibrating the coining punch during the squeeze. S Kobayashi and E G Thomsen (University of California, Berkeley), and Y Bocharov (former exchange student) superimposed an 800-lb vibrational load (at 130 cps) on the punch. **Tests with aluminum,** which they also described at the ASME meeting, **were not so effective (pressure reduced 5 to 7%),** but they attributed this to low amplitude used. Although this is not in the HERF area, **results tend to agree with basics of ultrasonic forming** (AM/MM—Nov 27 '61, p83).

CUTTING . . . Completely automatic threading on existing lathes can be done with the Dyna Mate pneumatic control which can be installed in less than one hour. Although it is presently adaptable only to the Hardinge HLV Series lathes, the **control is said to eliminate the manual efforts usually needed for precision threads:** Tool advance and retract, infeed, carriage control shift, and leadscrew stoppage are all automatic. Dyna Mation, Inc (Minneapolis) says the control **will cut any thread that can be cut on the lathe manually.**



WELDING . . . In the year or so since it was first reported in AM/MM, arc spotwelding (an offshoot of CO_2-shielded continuous arc welding) has gone to work at A O Smith, Milwaukee, **producing overlapping joints in mild sheet steel assemblies,** and at Chrysler, where it **makes stronger joints between sheetmetal parts than continuous welding.** Advantages over more-conventional welding techniques: cheaper, faster, better welds; simple tooling, no backup needed, power demand is low, equipment is simple, control is better. (Details in December 25 issue.)

MATERIALS HANDLING . . . Electrical capacities of nickel-iron batteries for fork trucks have been boosted 77%. The developer, Exide Div of Electric Storage Battery Co claims that **the new batteries can, for the first time, match the capacity of lead-acid batteries in industrial trucks.** The batteries produce electric current by transferring oxygen from the nickel oxide of the positive plate to the sponge iron of the negative plate—in an alkaline electrolyte which is non-corrosive. The batteries **can be stored indefinitely without danger of deterioration.**

Continued on next page

Coming in AM/MM

- *Arc spotwelding at Work*
- *Machining accurate deep holes*
- *Numerical gaging of precision parts*

METALWORKING REPORT ...

INSPECTION . . . A new camera literally photographs around corners to give a one-shot picture of an object's periphery. For example, the teeth of a hypoid pinion gear would look much like a rack when photographed with the development from Shell Oil's UK research laboratories. The camera is a conventional plate camera with a **special moving plate holder and variable narrow slit** between film and lens. Object to be photographed is placed on a rotating table, and its **whole surface recorded on one negative.**

PLATING . . . Rubber, glass, and other non- and semi-conductors can be made fully conductive by copper plating in an electroless bath called Enplate CU-400 by Enthone Inc (New Haven, Conn). After work is immersed for a few minutes in the warm bath, a dense, **fine-grained copper is deposited at 0.06 mils per hour.** Most non-conductors are made conductive after a 1-to-2-minute plating; however, for subsequent electroplating, the chemical process should be continued 10 to 15 min. One gallon covers about 40 sq ft.

SETUP . . . On really large jobs, move the machine—not the workpiece. This idea has slashed setup time as much as 50% for a British company, Davy-Ashmore of Sheffield. In the shop, **the work is positioned in the center of a huge workplate** (60 by 120 ft). Those machine tools that weigh less than the work are then brought up and located on the workplate. The workpiece, which might weigh as much as 150 tons, is moved (to the side of the workplate) only for horizontal boring and milling operations.

MATERIALS HANDLING . . . A new Yale electric truck has a drive motor for each wheel. When the truck makes a sharp turn, a control cuts out the inside-wheel drive motor. Results: **The truck is more maneuverable, and power losses are considerably reduced.** Thus, the truck's battery can do more work before it has to be recharged.

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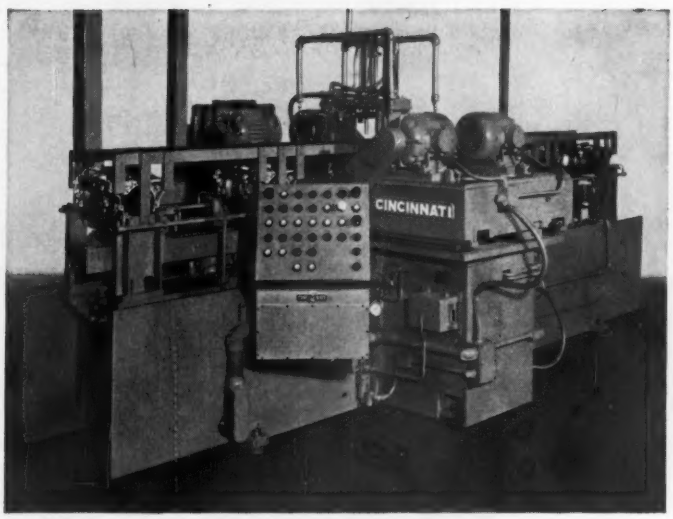

Four milling operations are performed on transmission cases at a rate of 220 per hour.

Cincinnati also builds transfer lines

More than thirty in seven years! With all the milling, grinding, broaching, heating, forming, and other machines we build, it's easy to forget that Cincinnati also has a genius for combining many operations in one automated production line.

We've built transfer lines to mill, drill, bore, ream, countersink, broach, profile, face and chamfer—even to insert bushings. These lines machine cylinder blocks, transmission cases, cylinder heads, crankshafts, manifolds . . . cast iron, steel and aluminum. Production rates have ranged from 53 to 220 parts per hour.

The wealth of experience gained by our Special Machine Division in designing and building these lines is available to you. It combines the resources of our Milling Machine Division, Grinding Machine Division, Meta-Dynamics Division (chipless machining and heating), Cimtrol Division (controls), Products Division (grinding wheels, cutting fluids), and Central Research Laboratory.

A story of one of our transfer lines is told on the next two pages. Tell us about the parts you need to machine at high production rates. Then watch Cincinnati experience go to work for you. Special Machine Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

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HORIZONTAL BROACHING MACHINES • COMPLETELY AUTOMATED PRODUCTION LINES

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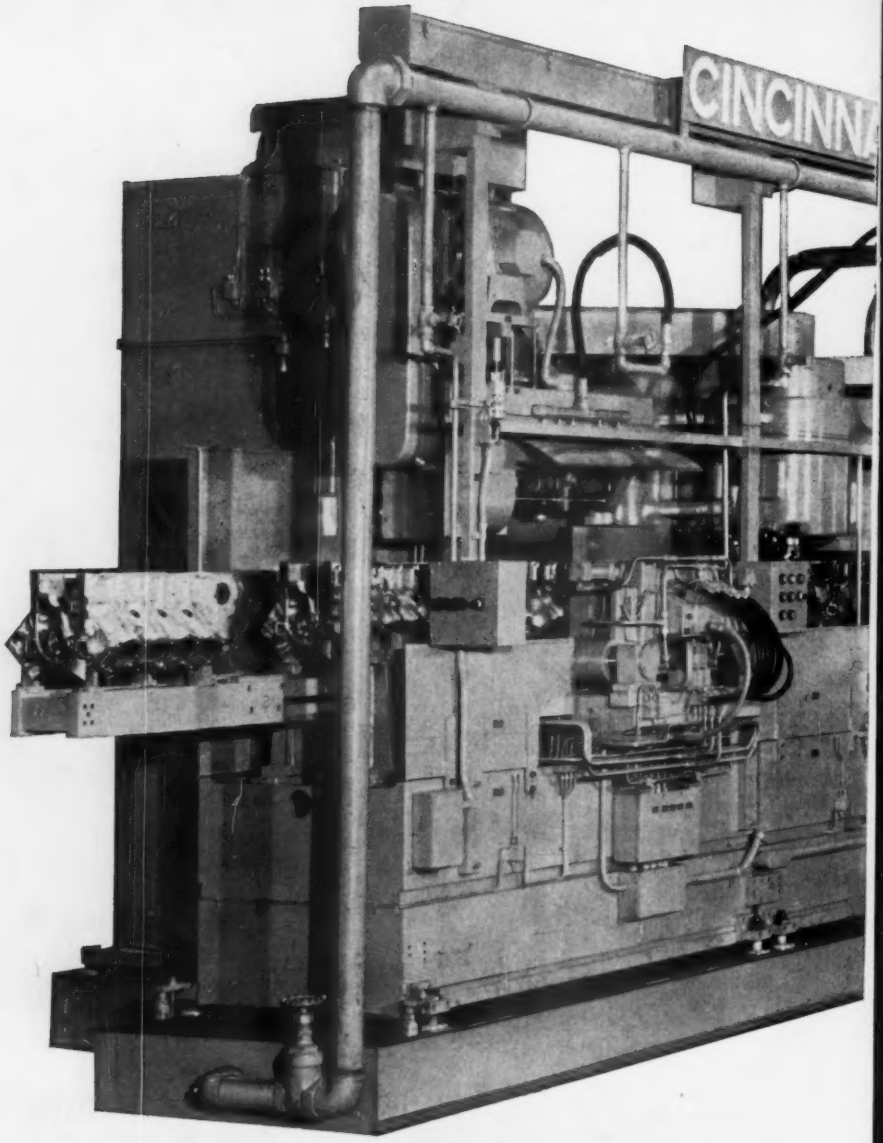
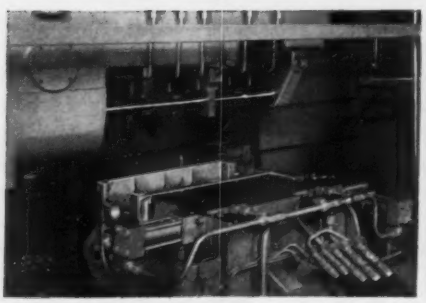
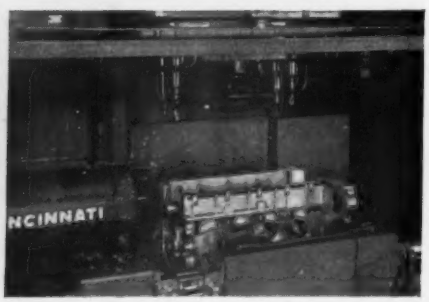




Main and line bearings are bored in the first station with a five-bit tool.



Generator mounting pad is straddle milled and two locating holes are drilled and bored.

CINCINNATI

DESIGNERS AND BUILDERS OF SPECIAL MACHINES • VERTICAL AND HORIZONTAL BROACHING

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

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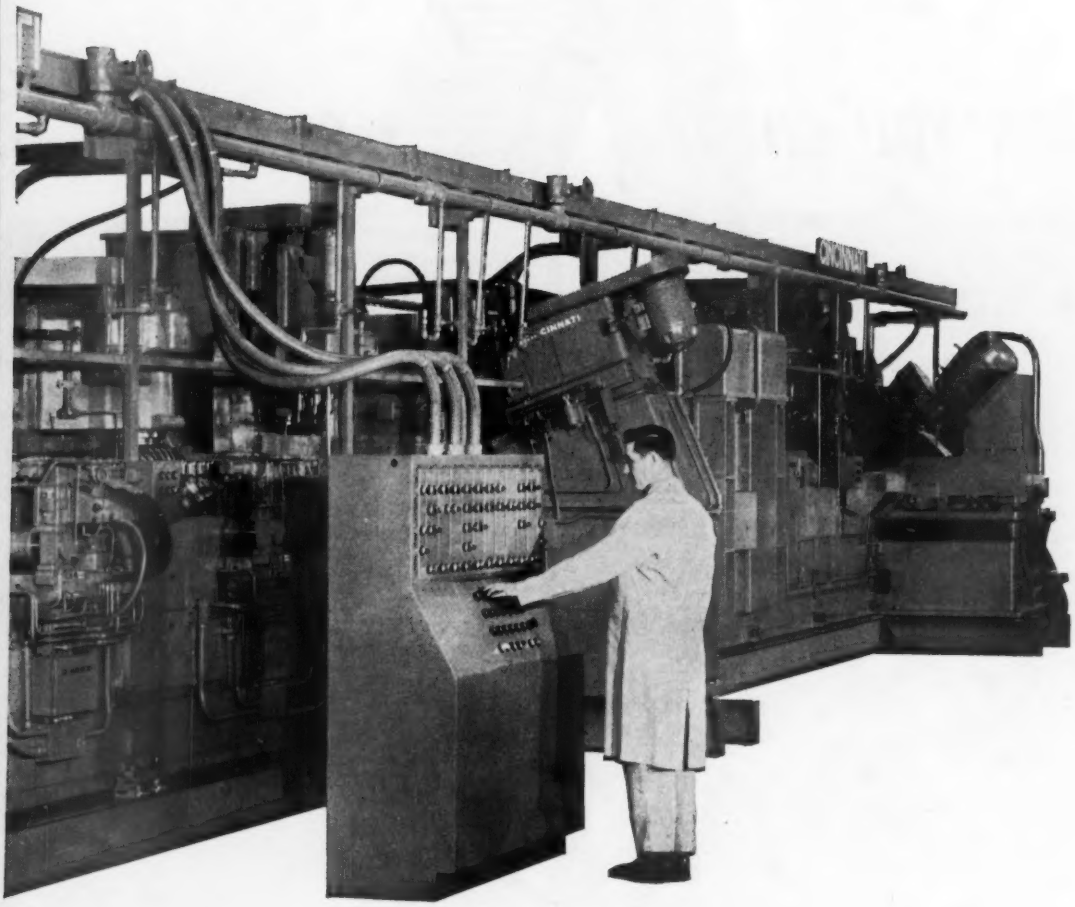
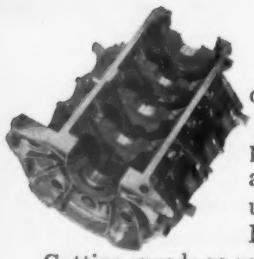


Designed with tomorrow in mind



We can't stop change, but we can plan for it.

As it stands, this transfer line performs 26 operations on two aluminum V-8 blocks every minute. Milling. Drilling. Boring. Broaching. Inserting bushings. Cutting speeds go up to 2,000 feet/min., feeds to 150 inches/min.

When models change, this Cincinnati will change too. Machining stations can be rearranged to change the sequence of operations. New stations can be substituted for existing stations. Additional operations may be included. If just the material changes, it's easy to adjust feeds, speeds and tools.

The eleven identical centerbed sections are finished on all sides. They are arranged for mounting wing bases in accordance with production machine tool standards of the automotive industry. Each bed section includes a walking beam transfer mechanism.

Today's special machines are not necessarily "single purpose" machines. They can frequently handle a family of parts and can usually anticipate future design changes. Investing in a CINCINNATI special machine tool today gives you a head start on tomorrow's problems.

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FELLOWS can offer both types of gear cutting machines

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FELLOWS GEAR SHAPERS, for cutting external and internal gears and other shapes, are built in a wide range of models. They range from a machine that will cut gears as small as 1/16-inch diameter and as fine as 200 pitch to one with a capacity of 120 inches and 2 diametral pitch.

FELLOWS-PFAUTER GEAR HOBBING MACHINES are now built in two sizes, the P 400 and the new P 630 (which has a capacity of 25 inches diameter 3 diametral pitch). PFAUTER GEAR HOBBING MACHINES are available in both larger and smaller sizes.

Why not ask a Fellows Representative for complete details? All Fellows Offices are at your service.

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FELLOWS NO. 4GS:
Max. P.D. — 6" ext. and int.;
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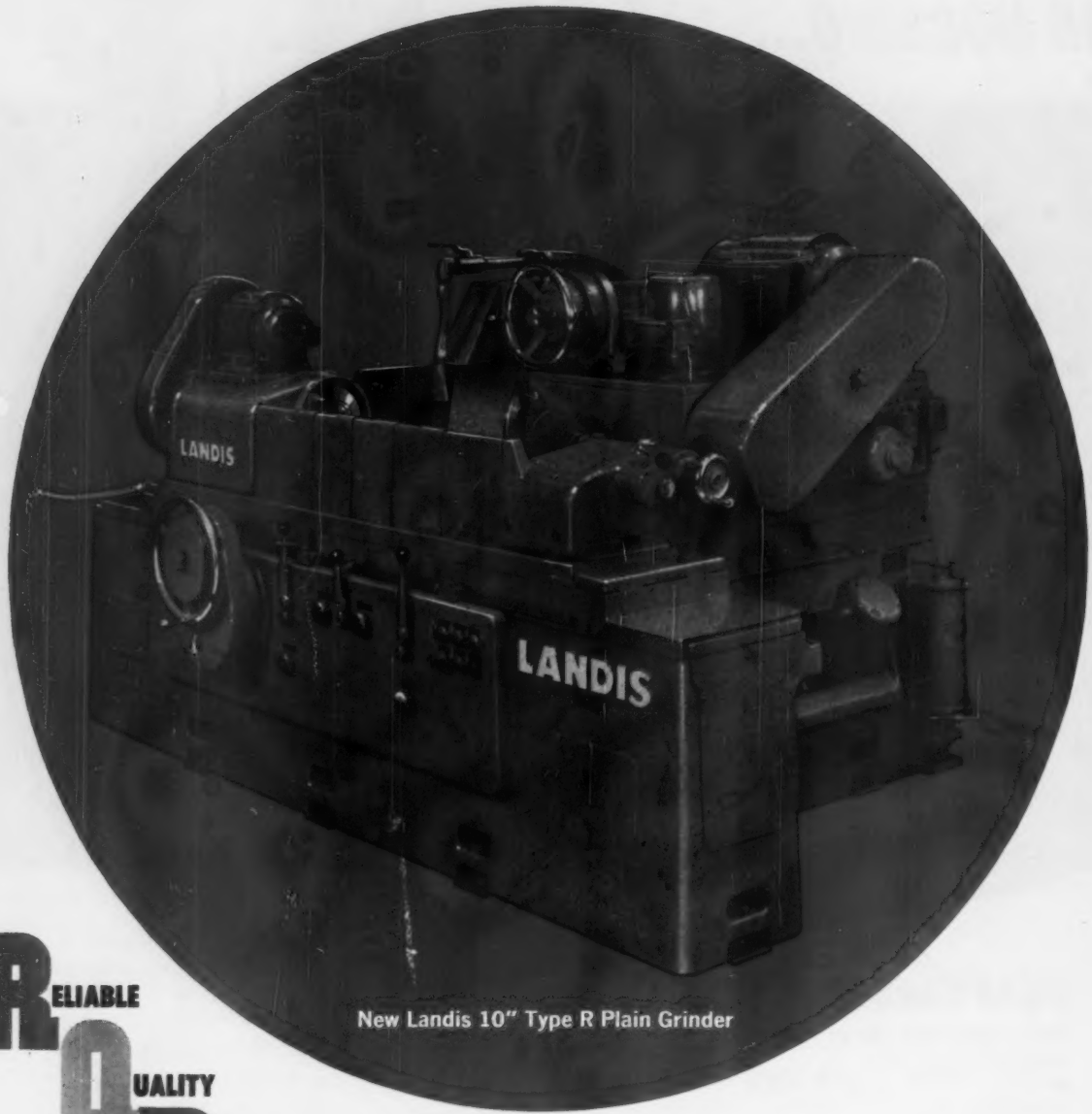
Fellows

Gear Production Equipment

Landis features give reliability to production grinding

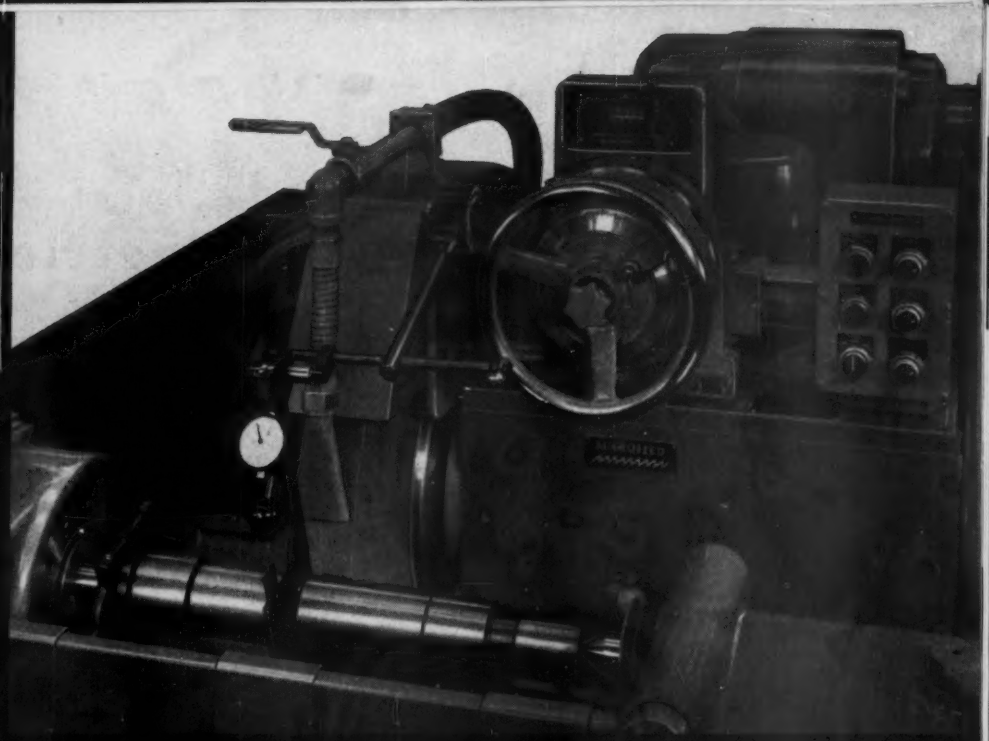


New Landis 10" Type R Plain Grinder

RELIABLE QUALITY PRODUCTION

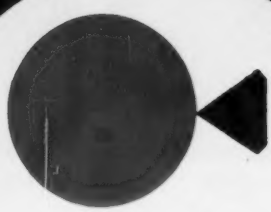
Consistent, automatic, repeat performance of a cylindrical grinder is dependent upon the combined reliability of all grinding machine essentials—work support, wheel support, wheelfeed and wheel dressing.

The exclusive features of the new Landis plain grinders are built around these four machine essentials to assure reliable, quality production.

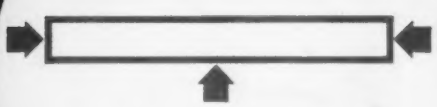


Wheelfeed. Exclusive Landis Microfeed® is an ultra-fine feed to final size. It is a pulse feed in millionths that automatically cancels all grinding variables such as wheel wear, machine temperature changes, wheel action and variations in workpieces.

Wheel support. Exclusive Microsphere wheel spindle bearing reduces sparkout time, speeds production.



Wheel dressing. Exclusive Landis Truform dresser with ball slide, shake-free construction. Assures exact duplication of all wheel profiles.



Work support. Exclusive wedge work rest and loaded ball spindle footstock give maximum rigidity to work parts.

LANDIS

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General Electric Makes Eddy-current-coupling Drives

And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them KINATROL* drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

A General Electric KINATROL drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

KINATROL couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

KINATROL —a good product, with the kind of service you can depend on. Please call your nearest General Electric Sales Office for further details.

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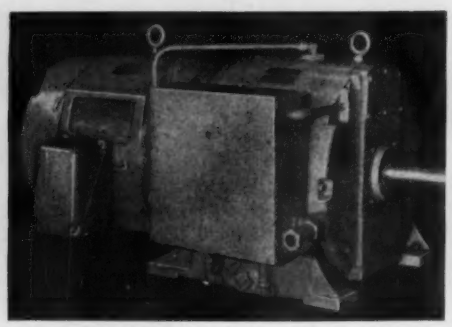
821-07

AIR COOLED, 7-1/2 to 100 HP



WATER COOLED, 25 to 150 HP

AIR COOLED, 1 to 5 HP

DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT

GENERAL ELECTRIC

ERIE, PENNSYLVANIA

Eight of twelve Landis Abrasive No. 1½ surface grinders at Glennie Industries, Inc., a precision tool and die manufacturer in Romulus, Michigan.

GLENNIE INDUSTRIES REPORTS:

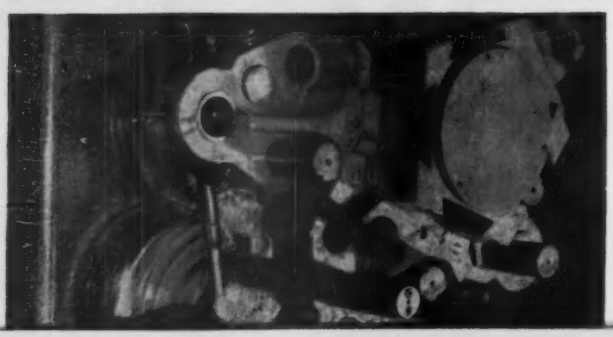
"Faster than any other hand operated grinder" for grinding punches and dies

Grinding the nose contour of an interchangeable ball type punch to tolerances of ±.0001".

At Glennie Industries, where grinding is the largest operation, Landis Abrasive No. 1½ surface grinders maintain high standards of precision and production. For similar results in your shop, request a call by a Landis Abrasive surface grinder representative.

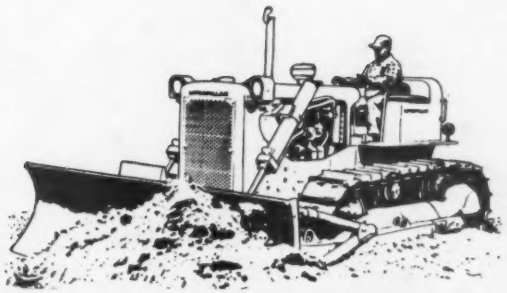
LANDIS

Landis Tool Company, Waynesboro, Penna.



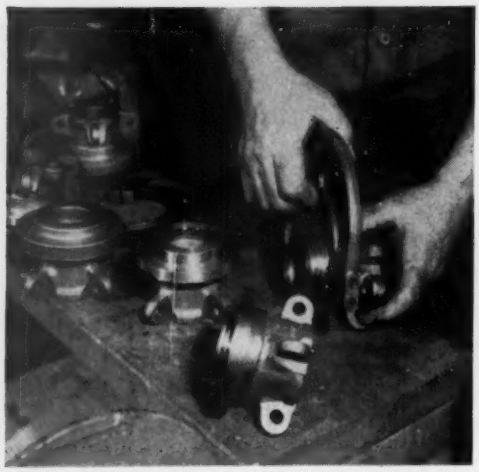
Caterpillar takes advantage of "AC" versatility and ease of tooling by handling the wide variety of work principally with standard tools. Tool costs and tooling inventory have been sharply reduced. The ability of "AC's" to use combined and multiple cutting techniques in unusual ways, and to hold close tolerances, taper-free bores and fine surface finishes provided further cost-savings by reducing subsequent operations.

AT CATERPILLAR TRACTOR CO.
Davenport, Iowa



Six "AC" chuckers automate "service parts" production in lots down to 50 pieces

Unique construction of W & S Single Spindle Chucking Automatics permits boring taper-free holes to .001" tolerances, eliminates machine alignment and operator problems experienced with old turret lathes.



"AC's" gave Caterpillar the quality control they were looking for. Tolerances of .001" are held without constant operator attention. Because of an "AC's" unique construction—spindle and turret mounted in the main column casting—machine alignment problems have been eliminated, assuring consistent taper-free boring.

Caterpillar's Davenport plant produces repair parts for non-current tractors. It's a typical jobbing operation—lot sizes usually run 50 to 150 pieces, with plenty of variety and little repeat work.

Older hand turret lathes had raised direct labor costs out of proportion. Operators needed extra time and skill to hold work within tolerances, while taper-free boring demanded frequent alignment checks. Even so, scrap losses were high. On top of these problems, Caterpillar wanted to eliminate some second chuckings and precision finishing operations.

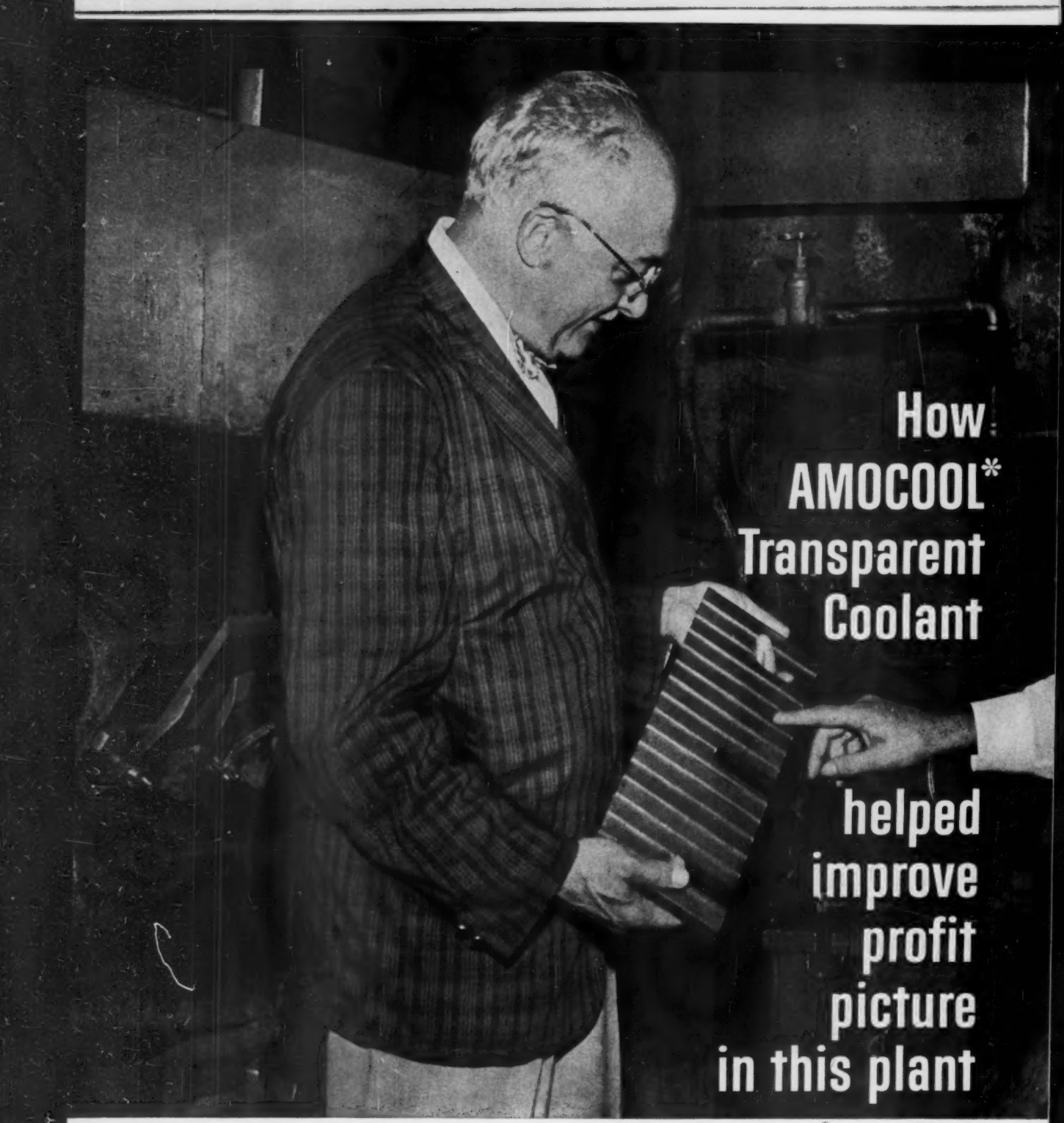
With the installation of 2AC and 3AC Chucking Automatics, Caterpillar's problems went out the door with the older machines. Today, rejects are almost non-existent. Tolerances of .001" are easily held, and many second operations have been eliminated. *Each "AC" averages 50% more pieces on the floor per day, with one operator handling two machines including setup.* And setup time to the first good piece takes ⅓ to ½ less time than on the hand machines—mainly because the older turret lathes required extra time to get the first piece within tolerance.

If you're faced with problems like these, Warner & Swasey can help you properly solve them. Call the nearest Field Engineer or The Warner & Swasey Company, Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY

CIRCLE 264 READER SERVICE CARD



How AMOCOOL* Transparent Coolant helped improve profit picture in this plant

*Trademark

BY PAUL E. "PAPPY" STRATTON

About the Author. "Pappy" Stratton has been providing technical help on lubrication and metalworking problems to customers in the Detroit area for nearly all of the twenty-five years he has been working for the company. In addition to having this store of practical experience to help him, Pappy has completed the Company's Sales Engineering School.

* * *

By using a soap-base grinding compound, Detroit Edge Tool Company was getting excessive corrosion and rust on work and grinding machines. Oil vapor was collecting on machines and on the ceiling, causing dirty working conditions. Most important, high wheel loading was causing frequent down-time for wheel dressings.

We worked out a test program on AMOCOOL Transparent Coolant with the management. On our first test on one surface grinder, feed pressure was cut substantially while at the same time metal removal was increased.

Eliminate reworking because of rust, reduce wheel loading and extend intervals between wheel dressings; do these and you increase profit per unit, explains Detroit Edge Tool president, Dan Ebbing, to P. E. "Pappy" Stratton of American Oil. Plant manager, John Yonker (right) and Sam Vineh, operator, look on.

The cost of reworking parts to remove rust was eliminated. Time required to clean machines to get rid of the odor was cut in half. Less wheel loading and fewer wheel dressings have upped production and reduced costs. Our test program paid out in an improved profit picture. All grinding and drilling equipment has been converted to AMOCOOL Transparent Coolant.

* * *

Would you like this kind of technical help to assist you in improving profits? Get it by calling the American Oil Company office nearest you.

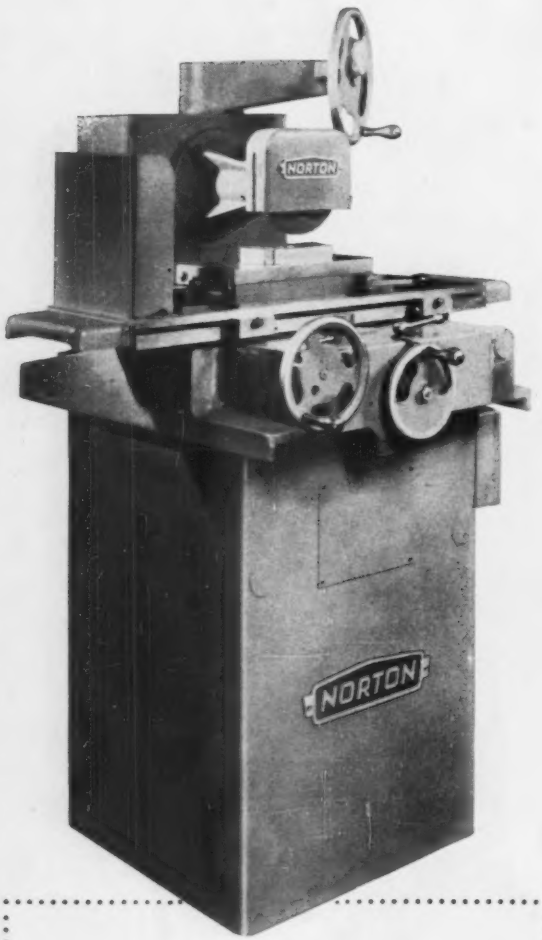
Quick facts about
AMOCOOL® Transparent Coolant

- Clear, transparent fluid
- Controls corrosion on work and machines
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Fire resistant
- Odorless

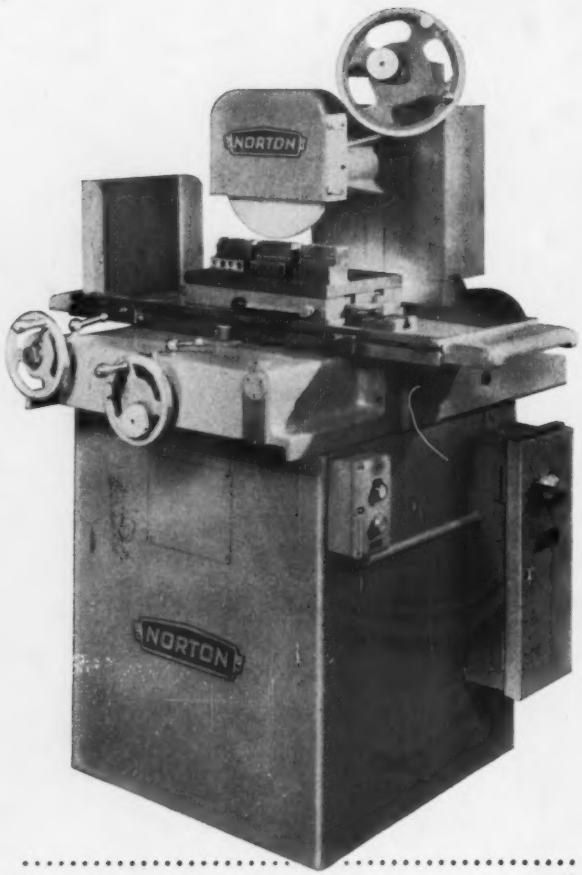
AMERICAN

AMERICAN OIL COMPANY
910 South Michigan Avenue
Chicago 80, Illinois

New Norton Hand



NORTON 6 x 12" Type TS Hand Surface Grinder Table travel up to 14". Cross traverse up to 7". Maximum height capacity 12½"*. Grinding wheel, 7" x ¾" x 1¼". Table traverse by hand through positive cable drive. One revolution of hand wheel moves table 6⅜", on friction-free ways.



NORTON 10 x 16" Type TS Hand Surface Grinder Table travel up to 18", cross traverse to 11", grinding wheel 12" dia. Extended wheel head ways assure maximum grinding support and full use of 12" vertical* capacity. Two-speed wheel drive. Fine cross-feed increments of .0005".

*Table top to bottom of full size grinding wheel.

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Surface Grinders....

Latest Norton developments...
simplified, rugged, versatile...
are welcome cost-cutters
for your daily toolroom jobs.

Like all Norton grinders — from highly complicated automatic production machines to simpler toolroom types — the new TS Type Hand Surface Grinders have the common denominator of *precision performance, easy operation* and *long service life*, built into them as follows:

Precision Performance. Two-speed wheel feed hand wheel has graduations of .0005″ for fast, accurate positioning, plus a vernier scale graduated .0001″ for precise grinding feeds. Rigid and long vertical slide and saddle design provide maximum support for moving parts, resulting in reduced vibration and better finish. Accuracy of center-guide cross feed is excellent for groove and shoulder grinding.

Easy Operation. Controls are at working height, for fatigue-free table and cross feed operation. Antifriction bearings under the table produce a smooth and easy motion for reduced effort. Table and cross slide controlled by hand wheels with no levers requiring crossed-arm operation when motions are simultaneous. These grinders are the only machines of their type with hinged wheel guard for quick wheel change.

Long Life. Anti-friction spindle is mounted in housing for rigid, rugged strength. Long vertical slide ways eliminate wheel "hang up" tendencies and provide large way areas. Deep saddle eliminates rocking, gives strong support for grind. Antifriction rollers cut wear on table and cross slide.

Over-all economy of NORTON TS Hand Surface Grinders is strengthened by many features such as their uncomplicated, accessible mechanisms and clean, uncluttered design which reduce maintenance costs. For details on how these new NORTON developments can cut your own daily grinding costs, see your Norton Man, a Trained Grinding Engineer. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. *District Offices:* Worcester, Hartford, Chicago, Detroit, Cleveland.

In Canada: J. H. Ryder Machinery Co., Ltd.. Toronto 18.

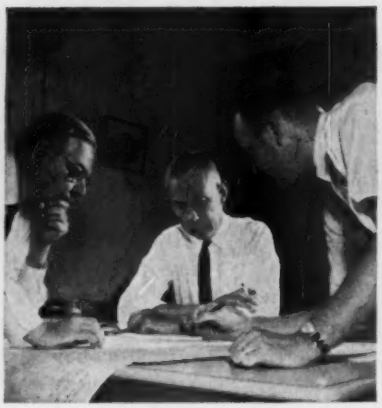
NORTON
MACHINE TOOLS

75 years of . . . **Making better products . . . to make your products better**

MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners

ANOTHER REASON TO SPECIFY **GENERAL ELECTRIC** NUMERICAL CONTROL

FREE FACTORY TRAINING for your personnel helps you maintain adequate preventive maintenance program.



EXPERT APPLICATION HELP is yours from engineers who have applied G-E control to over 50 machine types.

QUICK, EFFICIENT START-UP of machine is certain when field-based General Electric engineer assists.

Complete installation help, training,

When you insist on General Electric numerical control, you do more than assure yourself of profit-making machine-tool performance. Your specification automatically qualifies you for the industry's biggest "extra value" . . . General Electric's complete customer-service package.

General Electric "service" starts the instant your specifications are known. **G-E application engineers**—who work hand-in-hand with **every** major machine-tool builder—help to translate your needs into an integrated, automatic machining system which is completely "checked out" before it comes to you.

Then, **G-E field-based engineers** personally assist in installation, and start-up of your equipment to make sure it performs to specifications. Keeping it

NUMERICAL CONTROL
FOR AUTOMATION

SWIFT, EXPERT SERVICE is yours from General Electric engineers in cities throughout the country.

GENERAL ELECTRIC CONTROL SYSTEM PRE-MATCHED TO YOUR MACHINING JOB is the time and money-saving "payoff" of G.E.'s creative and comprehensive design, application, installation, and service engineering assistance.

maintenance services for every buyer

operating at peak efficiency is the job of **G-E service engineers** who are located in 90 principal cities all across the United States.

Another key customer service is General Electric's **factory training school**. To date, more than 1000 customer personnel have learned basic control theory, trouble shooting, and techniques for adjusting and testing G-E numerical control.

Get all the details on these General Electric "extra-value" services . . . a package unmatched by any other control builder. Contact your machine-tool builder or G-E Sales Engineer today. Or write to Section 795–14, General Electric Co., Schenectady, N. Y., for descriptive data. *Specialty Control Dept., Waynesboro, Virginia.*

Progress Is Our Most Important Product

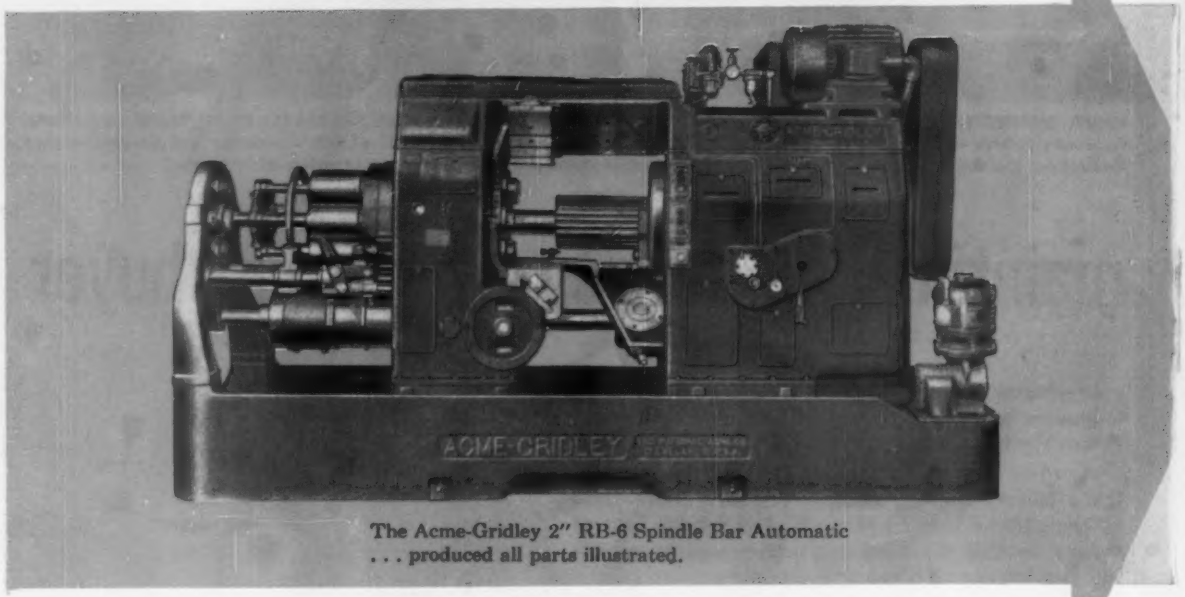
GENERAL ELECTRIC

ACME-GRIDLEYS CUT AVERAGE MACHINE TIME 75%

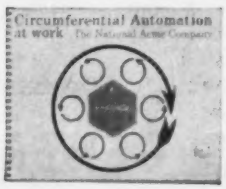
HELP HARDINGE BROTHERS HOLD THE LINE ON END PRODUCT PRICES

"There's no question about it . . . Acme-Gridley Bar Automatics are one of the reasons we haven't raised prices of our precision machines and attachments since 1956! And here's why" explains H. A. Lundy, Vice President of Hardinge Brothers, Inc., Elmira, New York, "when we need over 250 identical precision parts that can be grouped with other parts made from the same size bar, the job automatically goes on an Acme-Gridley. By switching jobs like those shown from conventional turret lathes, we reduce machine time an average 75% including setup time. With this kind of efficiency, it is economical to stockpile parts far beyond our immediate requirements, and take advantage of lower part costs to hold the line on selling price."

As Mr. Lundy says . . . there's no question about it. For short as well as long runs of identical precision parts, Acme-Gridleys are a sure way to cut production costs and increase earnings for years to come. Get in touch. We'd be happy to provide complete details.



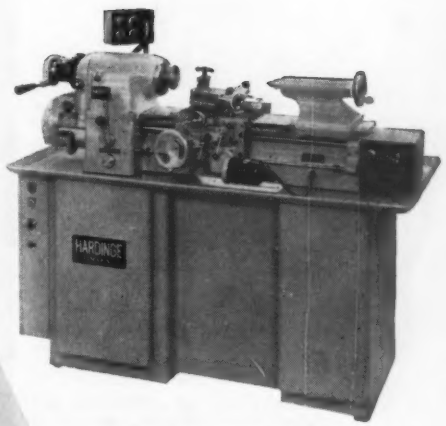
The Acme-Gridley 2" RB-6 Spindle Bar Automatic . . . produced all parts illustrated.



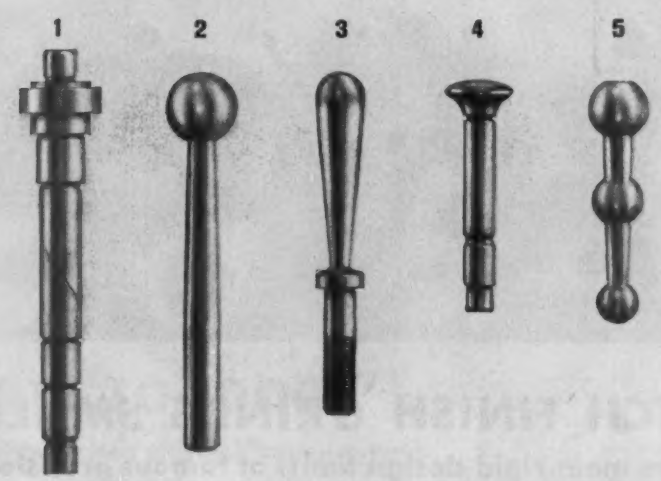
The number of *different* jobs that can be set up on any Acme-Gridley amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64-page bulletin called "Circumferential Automation at Work". For your free copy, call, write or wire.

HARDINGE PRODUCTION RECORDS ILLUSTRATE ACME-GRIDLEY SHORT RUN EFFICIENCY...

1 8620 Steel Clutch Cam. Run of 500 at 67 seconds per piece... 76.8% machine time reduction over previous method.
2 Rycase Steel Handle for Tailstock. Run of 850 at 59 seconds per piece...76.3% machine time reduction over previous method.
3 Rycase Steel Handle for Nut. Run of 1,100 at 61 seconds per piece ... 72.2% machine time reduction over previous method.
4 Rycase Steel Spindle Lock Pin. Run of 500 at 59 seconds per piece... 76.3% machine time reduction over previous method.
5 C1117 (leaded) Steel Crank for Screw. Run of 2,000 at 44 seconds per piece ... 89.2% machine time reduction over previous method. (All machine time reductions include setup time.)



The Hardinge HLV-H
Tool Room Lathe



HARDINGE
ELMIRA, N.Y.

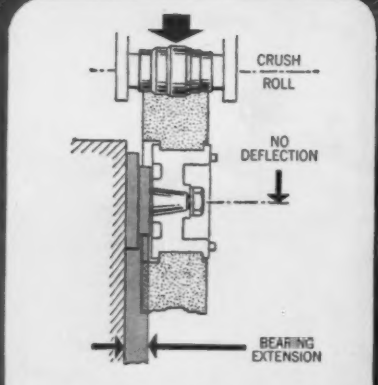
CIRCUMFERENTIAL AUTOMATION

National Acme

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

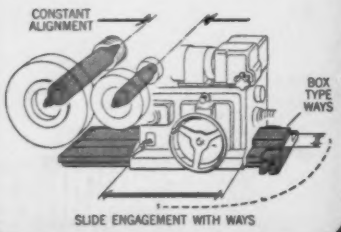
The National Acme Company
171 E. 131st Street
Cleveland 8, Ohio

Van Norman's Industry-Integrated Design Has Industry Talking!



Rugged, heavy Grinding Wheel Spindle with its additional bearing extension withstands the terrific pressures of crush roll-forming with NO DEFLECTION.

Maintained alignment of Grinding and Regulating Wheel Spindles is assured by the high engagement ratio of the Regulating Wheel Slide length to width.



HOW MICRO SWITCH FINISH GRINDS SMALL

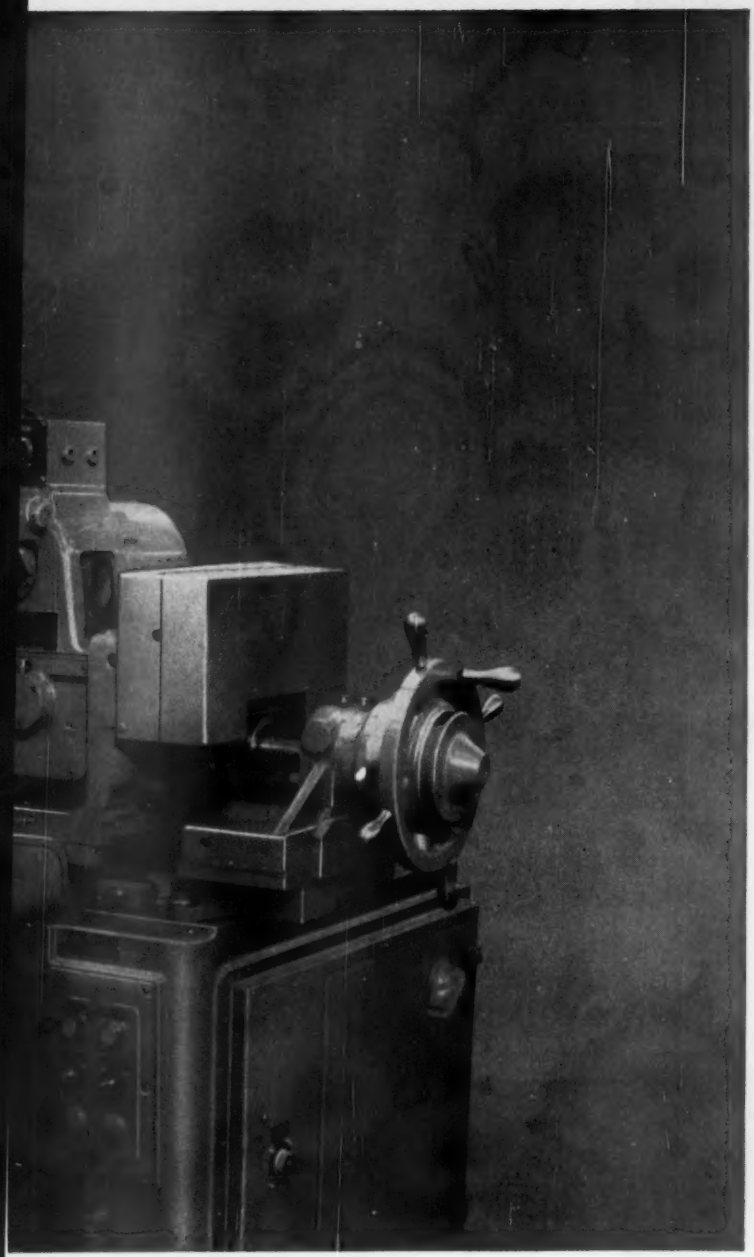
Van Norman Centerless Grinders meet rigid design limits of famous precision

Close tolerances in vital parts are indispensable to MICRO SWITCH, suppliers of over 12,000 types of precision switches to home, industry, defense. This division of Minneapolis-Honeywell Regulator Co. gets accuracy and economy with VN Grinders.

.0001" on Thru-Feed—.0002" on Infeed are met by VN units in volume-grinding actuator shafts and plungers for snap-action switches. Specs for multi-diameter concentricity and micro-inch finish are routinely held at high outputs (1,000 to 2,000 parts per hour on thru-feed; 120 to 250 on infeed).

Fast, Smooth, Vibrationless Operation is designed into VN Centerless Grinders. Massive construction—well-coordinated components—lifetime-sealed spindle units. Result: strict control over work deflection . . . no warm-up, no chatter. no "creep." VN hyd. profile diamond dressing

VAN NORMAN
SPRINGFIELD 7, MASSACHUSETTS



PARTS TO .0001"

snap-switches at high output-rate

on both wheels, with cams for straight or multi-diameter parts.

Variable Speeds, Easy Set-Up, Operation Control. Two regulating wheel speed ranges: 13-80 and 140-830 RPM. Capacity 0-1½" dia. Optional: VN Crush Dressing Attachment.

Free Booklet—"Centerless Grinding"—valuable guide to high production, lower costs. For your copy, contact factory or your local distributor.

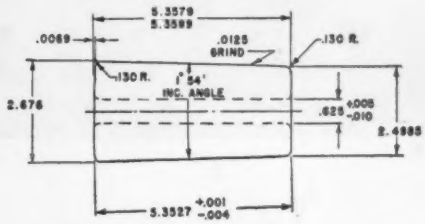
MACHINE COMPANY

A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

VN

Another typical Van Norman centerless grinder cost-saving application

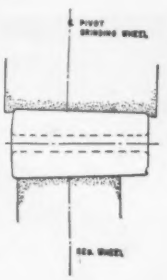
CUSTOMER'S PROBLEM:



To grind taper on large roller bearing, including blending radii on both ends. Parts to be green ground, hardened, then finish ground. Customer wanted to increase production as well as get more pieces per dress. Runout limit required: .0001" minimum. Finish to be 15 RMS or better. Previous operation produced approximately 17 pieces per dress on rough grind, and approximately 25 on finish grind. Stock removal was .020" to .025" on rough grind, and .005" on finish grind.

VAN NORMAN SOLUTION

Crush grinding the taper and radii simultaneously. Then finish grinding the radii, leaving .005" on the O.D. After heat treating—grinding the O.D. only, removing .005" of stock and holding a 15 RMS by diamond dressing the wheel.



THE RESULT:

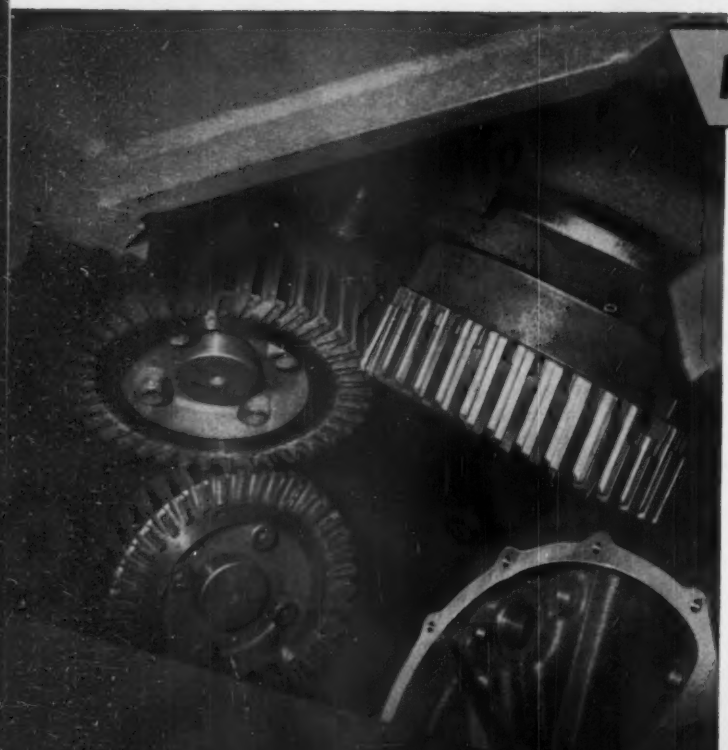
Rough grinding is performed in 30 seconds, with the removal of .020" to .025" on the O.D. and approximately .005" on the radii. Pieces per dress: 160, and without visible signs of taper or chatter. Finish grinding rate is 7.7 seconds per cycle, with 245 pieces per dress, and a 9 to 12 RMS held without runout or chatter. This exceptional accomplishment is one more example of how production efficiency can be stepped-up through the application of Van Norman Centerless Grinders.

2609

MILLING

THROW-AWAYS or BRAZED?

Wesson can help make it easier to decide . . .



MILLING

Compare these two jobs. One called for a Wesson Rigidcut. The other for a Wesson throw-away insert cutter. Why? Finish milling cylinder block top and faces (left) called for 9 in. cutters at 80 ipm. feed and 400 fpm. cutting speed. That's almost ½ in. feed per revolution and calls for all the blades you can get to keep down chip load. This Wesson Rigidcut mill uses 38 blades . . . better than 4 per inch of diameter. You couldn't do that with a T-A cutter or almost any other cutter.

For the crankshaft job (above) Wesson recommended T-A cutters. While production was satisfactory with another type, grinding costs and downtime were high. The switch to T-A's dropped tool costs from over $10,500 to less than $4,400 for the same output per year. Less downtime was a 'plus'.

CIRCLE 275 READER SERVICE CARD

You can now quickly adjust throw-away insert and other types of boring tools to tenths of a thousandth (in a range of up to ¼") using a vernier scale on the boring bar. Available in standard and special boring tools. Ask for Bulletin #B-1259.

WHICH FOR MILLING . . .

. . .

Wesson makes milling cutters—with both throw-away and brazed inserts. Your Wesson field engineer is a "pro".

Ask him to study your high-tool-cost operations and tell you which cutter type he recommends . . . and why. Wesson tools are guaranteed to perform as specified.

He can do this for 4 reasons:

1. **He is a real pro on boring, milling and turning.**
2. **He'll study your jobs thoroughly right in your plant.**
3. **He lives with the job and makes it work.**
4. **He is backed by 4 specialized tool plants, plus our own metals plant, and basic research, application research and tool engineering staffs.**

His on-the-job analysis costs you nothing and can point the way to major savings YOU can make.

Ask him to call on you soon.

A new 8-page booklet from Wesson analyzes all the factors involved in picking the best type of tool—throw-away, brazed or on-end type for turning operations. Ask for your copy today.

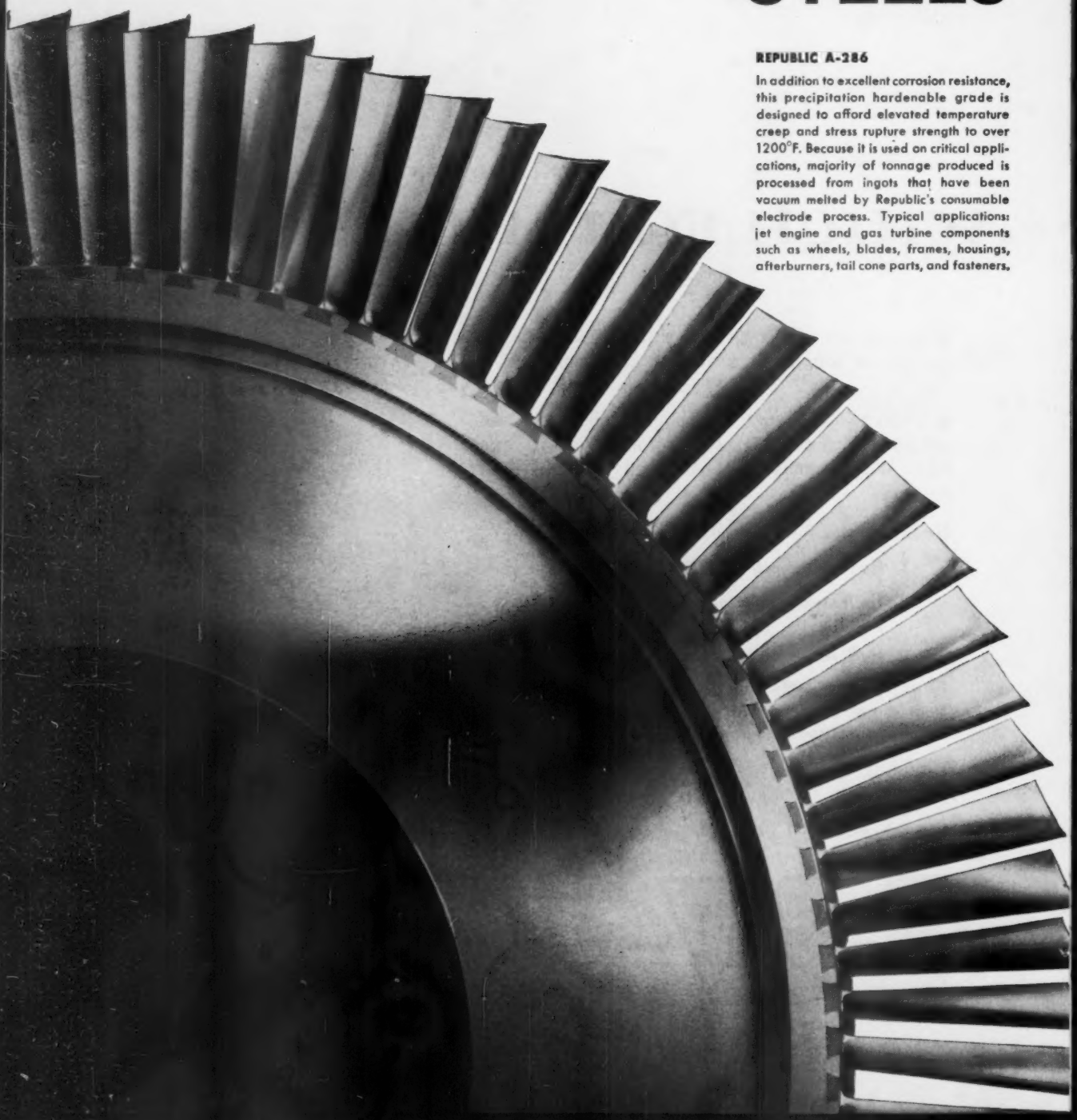
WESSON

WESSON CORPORATION 1220 WOODWARD HEIGHTS BLVD., FERNDALE 20, MICH.

PLANTS IN: LEXINGTON, KENTUCKY • FERNDALE AND BRIGHTON, MICHIGAN

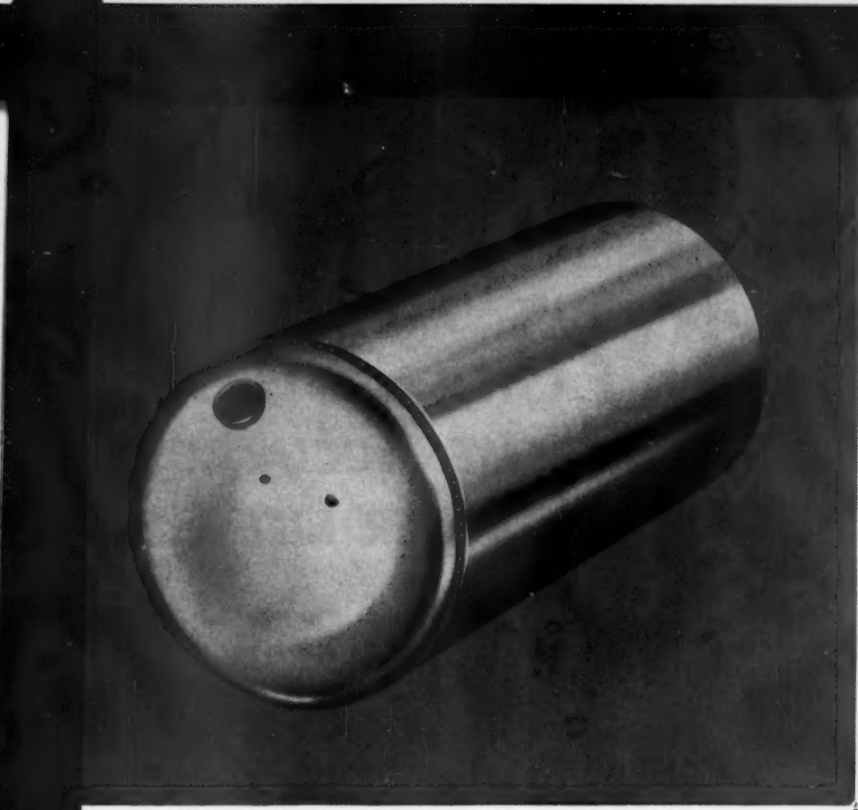
Strong
Modern
Dependable

REPUBLIC PH STAINLESS STEELS



REPUBLIC A-286

In addition to excellent corrosion resistance, this precipitation hardenable grade is designed to afford elevated temperature creep and stress rupture strength to over 1200°F. Because it is used on critical applications, majority of tonnage produced is processed from ingots that have been vacuum melted by Republic's consumable electrode process. Typical applications: jet engine and gas turbine components such as wheels, blades, frames, housings, afterburners, tail cone parts, and fasteners.



REPUBLIC 17-7 PH* and PH 15-7 Mo*

These steels possess the cold formability of austenitic stainless grades . . . the hardenability of martensitic grades. High strength levels and good creep resistance are maintained at temperatures to over 700°F. and 900°F. respectively. Typical applications: aircraft and advanced missile structural parts, bellows, hose clamps, leaf springs and spring clips, pressure tanks, surgical instruments, antennae.

REPUBLIC 17-4 PH*

Simple heat treatment after fabrication develops high strength levels without excessive distortion or scaling. Unlike most martensitic chromium types, Republic 17-4 PH* is welded without preheating or post annealing, thus resulting in lower fabricating costs. Typical applications: bearings, bolts, shafts, aircraft fittings, gears, splines, mandrels, pins, seats, and valves.

BECAUSE THEY OFFER GREATER VERSATILITY, precipitation hardenable stainless steels broaden the already wide field of stainless steel applicability. Better properties at elevated temperatures are coupled with the formability and corrosion resistance of other stainless grades. Republic PH Stainless Steels are available in the standard mill products. Mail coupon for data.

REPUBLIC STEEL

Cleveland 1, Ohio

REPUBLIC HAS THE FEEL FOR MODERN STEEL

**Licensed under Pat. Nos. 2482096, 2505763 and Trade Mark of Licensor.*

CIRCLE 278 READER SERVICE CARD

REPUBLIC STEEL CORPORATION
DEPT. AM-4
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send more information on:

☐ Republic 17-7 PH and PH 15-7 Mo
☐ Republic 17-4 PH ☐ Republic A-286

Name_____ Title_____

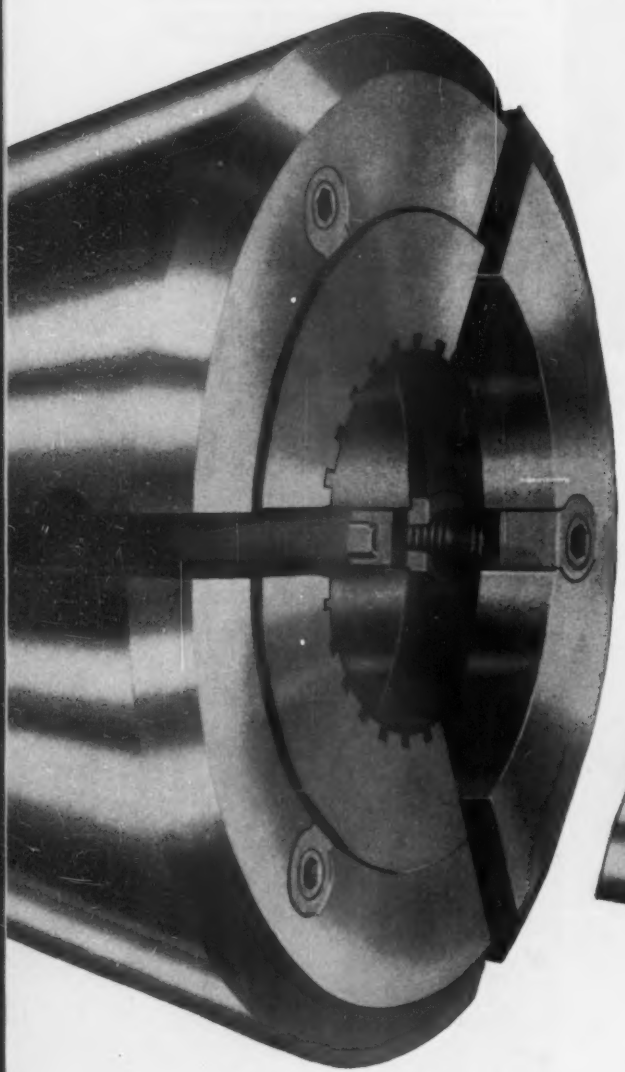
Firm_____

Address_____

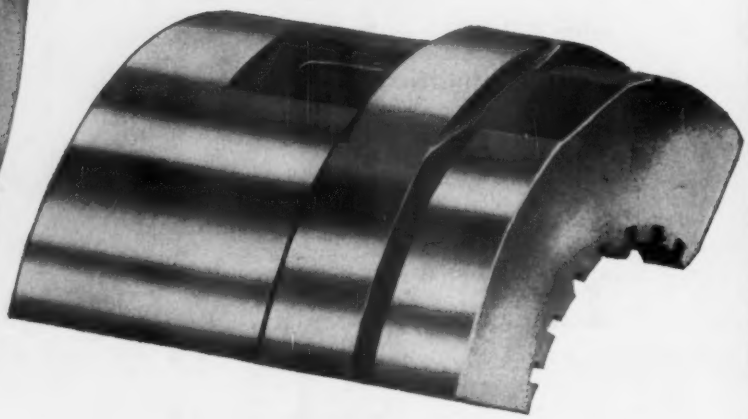
City_____ Zone____ State_____

HARDINGE
ELMIRA, N.Y.

FOR FASTER SET UPS EXTREME ACCURACY LONGER LIFE



CHANGE TO HARDINGE STYLE "S" MASTER COLLETS AND PADS



THE ONLY MASTER COLLET WITH NO WORK PRESSURE ON THE SCREW

Available From Conveniently Located Stocks for: Cleveland, Cone, Greenlee, Gridley and Acme Gridley, National Acme, New Britain and Warner & Swasey Automatic Screw Machines.

Write for FREE Descriptive Literature

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

All LAPOINTE

BROACHING MACHINES

are available for **LEASE**

on a low cost leasing plan from

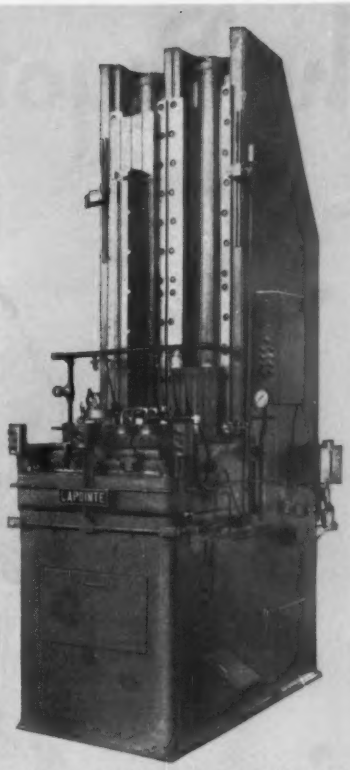
CHANNING LEASING COMPANY

No need to wait . . . you can acquire these efficient Lapointe Broaching Machines *now* — without delay. You can replace outmoded machines and methods, and convert to Lapointe-Broaching without tying up working capital or jeopardizing your cash position. As examples of the feasibility of leasing, we present here the leasing rates for two typical Lapointe Broaching Machines, and we earnestly suggest that you look promptly and thoroughly into this matter of leasing!

THE LAPOINTE MACHINE TOOL COMPANY

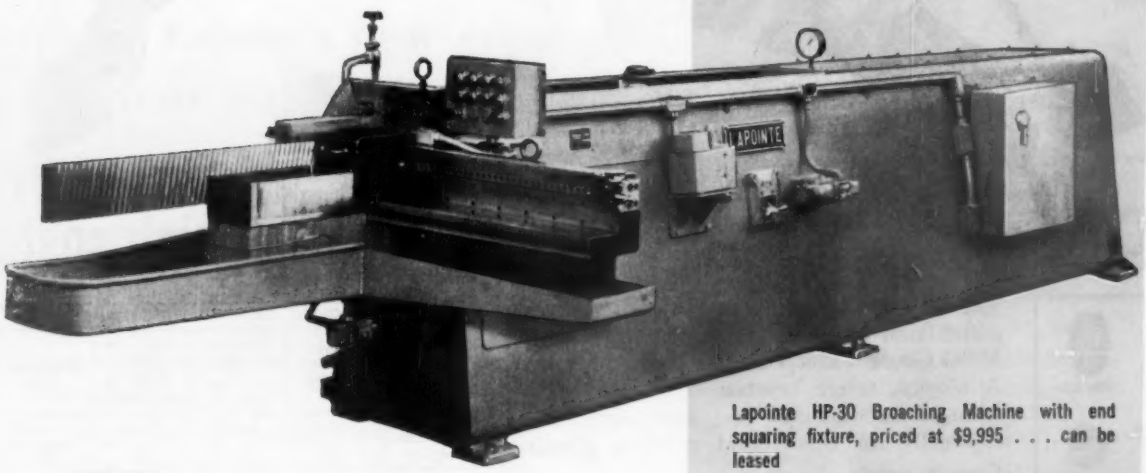
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



Lapointe 10-ton, 66-inch stroke DRV Broaching Machine, priced at $28,650 . . . can be leased on an 8-year schedule (based on 240 work days per year)

at only $20.95 per day



Lapointe HP-30 Broaching Machine with end squaring fixture, priced at $9,995 . . . can be leased

at only $7.46 per day

Other machine tools and equipment are available on the low cost Channing Leasing Plan, at rates comparable to those quoted here for broaching machines.

If you can profitably use any new machine in your plant, it will be to your advantage to write for our folder "Why Lease".

CHANNING LEASING COMPANY

NATICK, MASSACHUSETTS

LAPOINTE

known to be the best in

BROACHING

The Payoff is Performance

G-E Man-Made diamond checks low output, high costs

This is just what you *can* do when you use metal-bond grinding wheels containing type MBG General Electric Man-Made diamond. A blocky, tough crystal, G-E type MBG Man-Made diamond has been developed especially for metal-bond grinding wheels.

Case in point:

In a production test involving electrolytic grinding of more than 311,000 miscellaneous carbide tools, 6 wheels with G-E Man-Made diamond were compared with 6 wheels containing natural diamond.

ELECTROLYTIC GRINDING PERFORMANCE				
Diamond Type	Average Wheel Wear Inches	Average Cubic Inches Carbide Removed	Avg. Cu. In. Carbide Removed Per Cu. In. Wheel Wear	Efficiency Ratio
G-E MBG	.0605	90.885	70.2	122.5
Natural	.0644	80.181	57.3	100.0

Results: *a 22.5% superiority for G-E Man-Made diamond over natural diamond!*

Let your own tests validate the benefits of G-E Man-Made diamond in your metal-bond grinding operations. You'll find *the payoff is performance.* Call your wheel supplier soon.

METALLURGICAL PRODUCTS DEPARTMENT

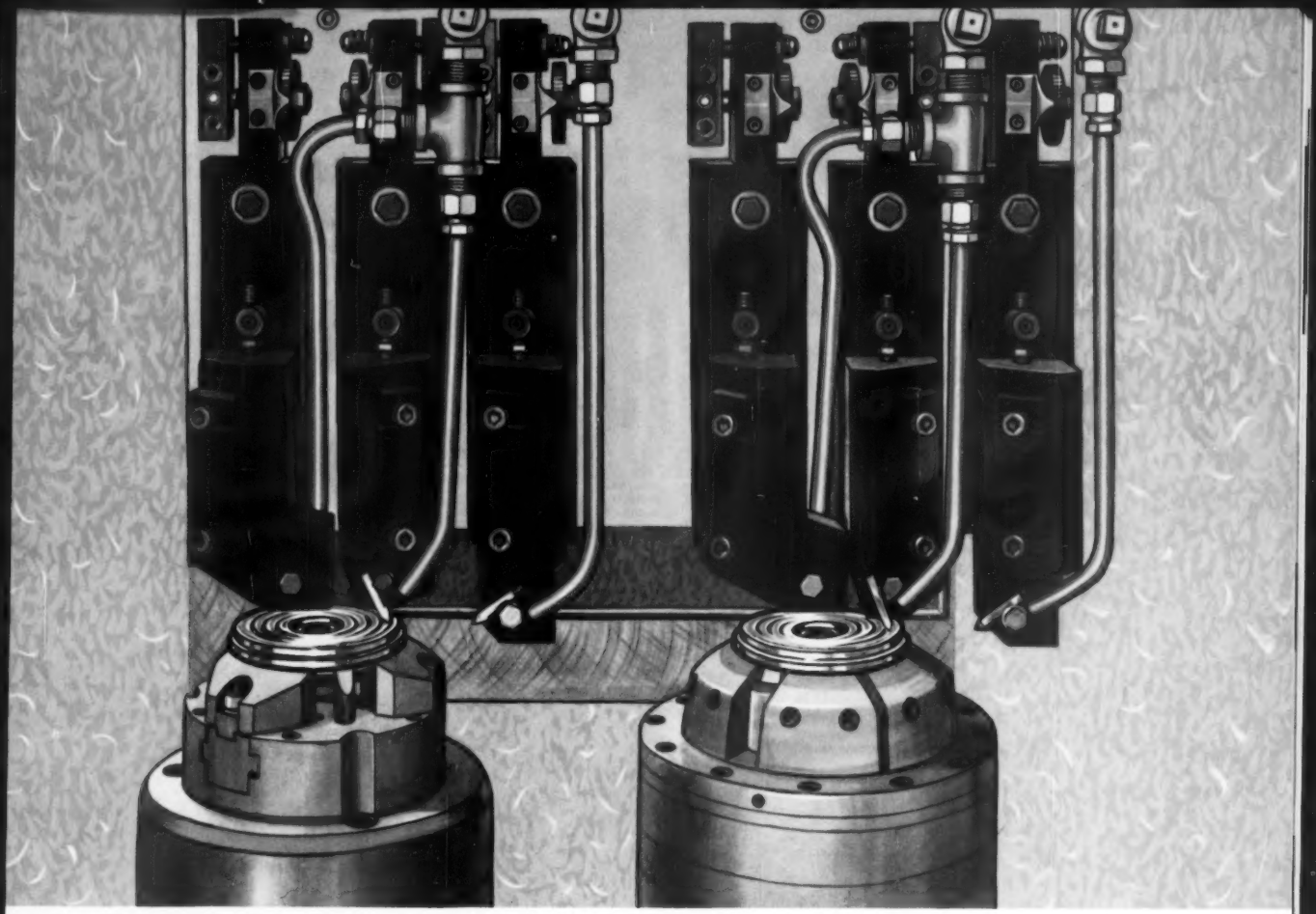
GENERAL ELECTRIC

11149 E. 8 MILE STREET, DETROIT 32, MICHIGAN

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMOND • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

CIRCLE 281 READER SERVICE CARD

CIRCLE 282 READER SERVICE CARD ►



New Britain's new concept for contour turning and boring

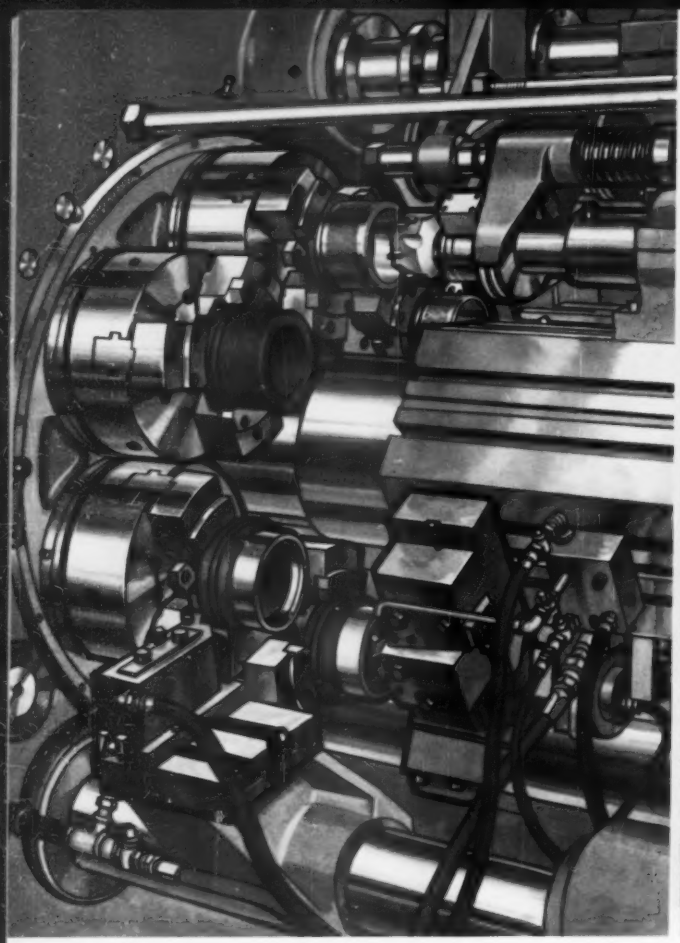
Beyond a certain point, continued refinement of existing designs in machine tools ceases to make an appreciable contribution to performance. Thus in designing our New Series of Vertical Precision Boring Machines, we have incorporated several completely new design concepts to provide improved performance and greatly increase over-all usefulness.

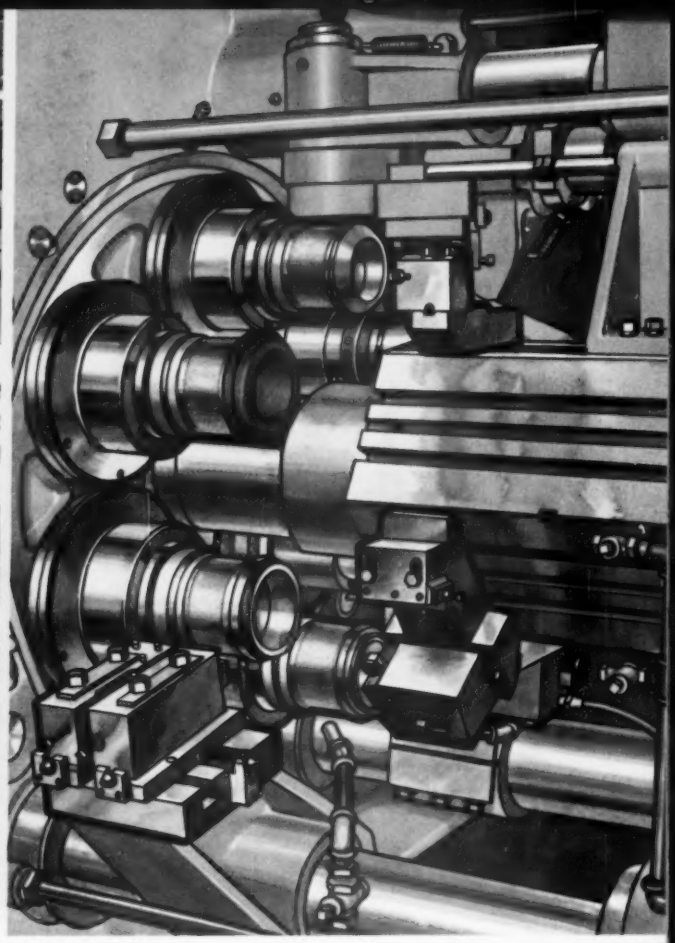
For the first time machines of this type can be used as building block units. Their clean-sided design permits any number of self-contained machines, each with one or more spindles, to be arranged side by side and operated as a single unit. They also may be operated with equal efficiency as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine.

In order to take the fullest advantage of the precision inherent in cam control, long linkages between cams and slides have been eliminated. A pair of cams is mounted on a common shaft which is carried *within the vertical slide*. Since all slide actuating forces are contained in the vertical slide, both cams are directly adjacent to the slides they control and no outside forces are imposed on the slide ways. The result is maximum rigidity for heavy cuts coupled with extreme accuracy for close tolerance work.

This unique and eminently workable approach to contour turning and boring results in the highest order of accuracy on even the most complex pieces. Your New Britain Representative can give you details on the nine different models available in this series. For catalog material, write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division - New Britain, Connecticut





New Britain . . . still the best Chucker you can buy

We're not unhappy about the fact that for years, in many plants, the name New Britain has been synonymous with chuckers. New Britain Chuckers have turned out literally millions of pieces of work for practically every major industry in the world. This is less important to the prospective buyer of one of these machines, however, than the capabilities of these machines today. How do they stack up against other chuckers or even other types of machines capable of doing similar work? Pretty well, we think.

New Britain's open-end design still can't be beat for unlimited accessibility to the tooling area. This same wide-open feature makes it doubly more practical to adapt these machines to automatic loading and unloading.

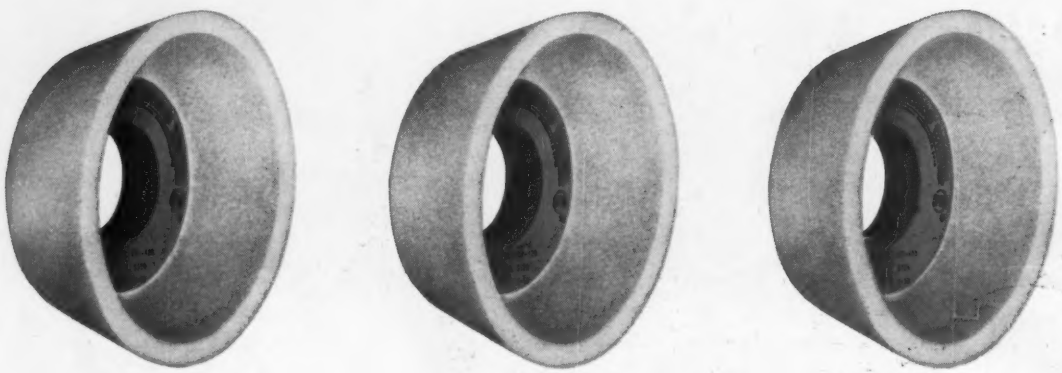
The unusual combination of longitudinal and transverse forming motions is another unbeatable New Britain feature. The massive forming arms on New Britain Chuckers allow heavier cuts and cuts of much greater complexity. This ability to do more work can eliminate the need for second operation machines in many instances. For really complex work, two chuckers set up side by side, as shown here, each doing one side of the piece, can smooth the way for high production. Less complicated work can be set up to perform both sides of the same piece on a single machine.

These massive machines provide the tooling combinations, spindle speeds and power to perform the widest possible variety of work. Their basic design will stay new for years to come, continuing to provide profitable operation. You may know New Britain Chuckers, but you may not be fully aware of the improved series presently being offered. Why not call your New Britain Representative or contact us at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division - New Britain, Connecticut

POSITIVE DUPLICATION—EVERY TIME!



Music to please you is identically reproduced by these three hi-fi records pressed from the same master recording. The three toolroom grinding wheels (above) will also please you with their masterly Positive Duplication. That's because they are CINCINNATI (PD)* GRINDING WHEELS.

FAMOUS, UNIQUE (PD) PROCESS

Unique in the industry, the famous Cincinnati (PD) manufacturing process is governed by 36 unvarying quality control steps. Print-weigh tickets, for example, must match the weights for every mix—*exactly* as specified on the Master Card which controls every operation in the rigid procedure.

UNIFORM, PREDICTABLE PERFORMANCE

This extraordinary attention to manufacturing detail results in wheels of unsurpassed uniformity.

You can reorder CINCINNATI WHEELS with confidence, because they give you the same good job time after time after time. You use fewer (PD) wheels because they last longer.

CALL CINCINNATI TODAY

Factory trained by the Cincinnati Milling Machine Company, our grinding specialists are available to you for consultation on all your grinding problems. Call your CINCINNATI GRINDING WHEELS Distributor, or contact us direct, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI*
GRINDING WHEELS

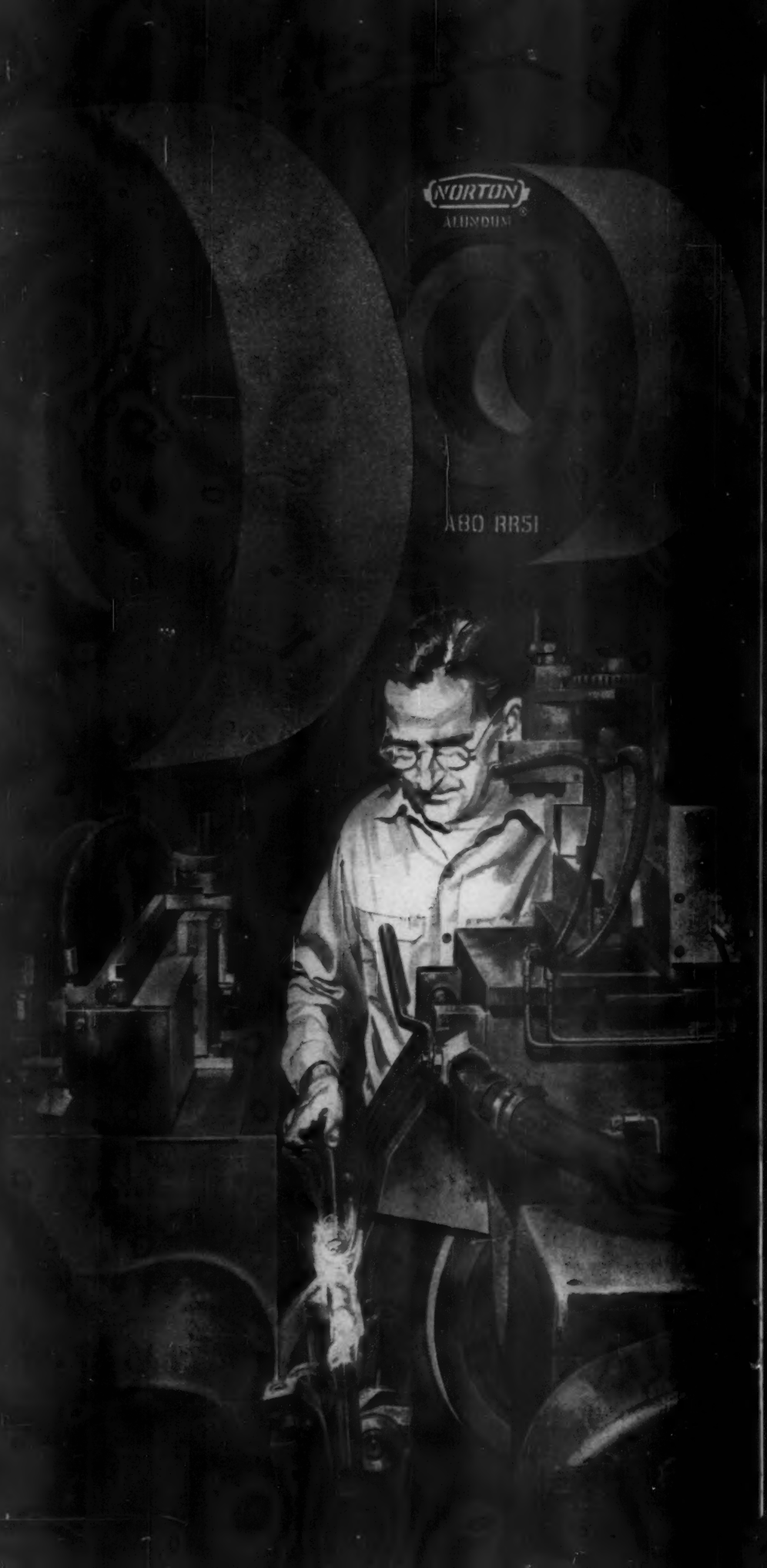
*Trade Mark Reg. U.S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

◄ CIRCLE 283 READER SERVICE CARD

CIRCLE 284 READER SERVICE CARD

NEW *from* NORTON



The top-ranking wheel team for centerless grinding

The 23 ALUNDUM grinding wheel and R51 feed wheel . . . the best performing, longest lasting combination on any centerless grinder.*

Although centerless grinding is a two-wheel operation, it doesn't need to be a two-brand buying chore.

HERE'S WHY.

Norton now offers this outstanding wheel team for production-precision and economy in centerless grinding . . .

- *The 23 ALUNDUM grinding wheel for premium performance at non-premium price.*
- *The R51 bond feed wheel for positive feed and accurate work support plus long service life.*

23 ALUNDUM Abrasive is no ordinary aluminum oxide. In price it is *non*-premium . . . but with *premium* toughness and sharpness . . . and fast, free cutting action that means *premium* performance.

23 ALUNDUM wheels have other important advantages: friability, which minimizes dressing . . . uniform duplication, for uniform performance . . . and versatility, for grinding all steels, Meehanite, aluminum and many other metals.

Teammate R51 is not just another feed wheel. This special Norton abrasive-and-bond combination has thoroughly proved the importance of the feed wheel to accurate, low-cost centerless grinding.

Reports from plants all over the country credit R51 wheels with exceptional performance, minimum dressing and no slipping or chatter. And Norton quality control keeps them uniform from wheel to wheel and lot to lot.

On the new Norton No. 2 Straddle-Bearing Centerless Grinder — or on any other machine of this type — 23 ALUNDUM grinding wheels and R51 feed wheels make your best matched team for low cost, volume production centerless grinding. For expert aid in wheel selection, and a test run in your plant, see your Norton Man, a trained Abrasive Specialist, or your Norton Distributor, NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world.

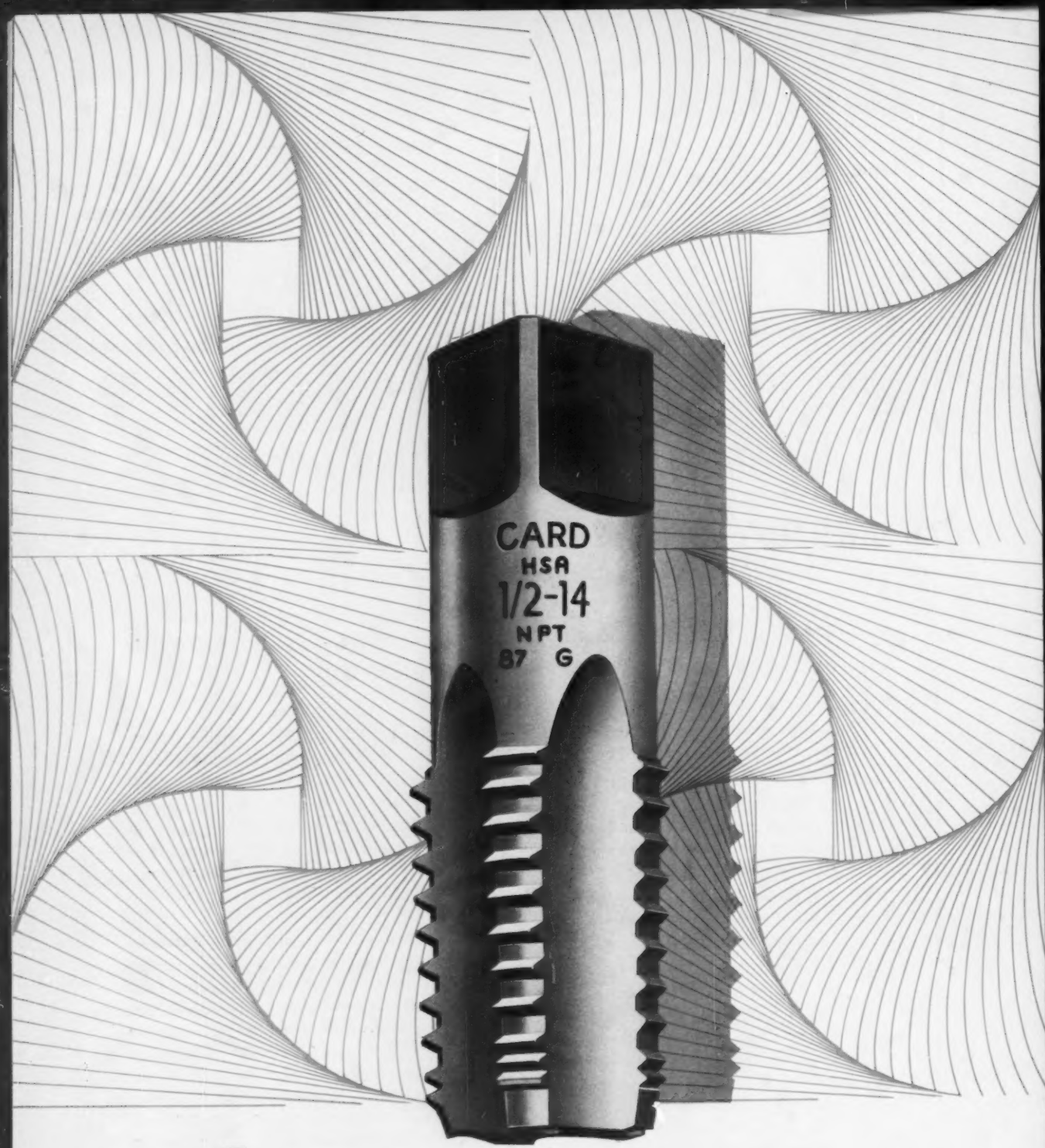
*Trade Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

W-2011

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



TAPS

DIES

GAGES

SCREW PLATES

GEOMETRIC PROGRESSION symbolizes the precise duplication you need in cutting tools. CARD makes sure you get this production advantage in actual form . . . through expert engineering that reproduces CARD tools exactly, plus helpful service from your CARD distributor and the CARD technical man, who are quickly available in the nation-wide CARD network. CARD DIVISION, Union Twist Drill Company, Athol, Massachusetts. CARD Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

CIRCLE 287 READER SERVICE CARD

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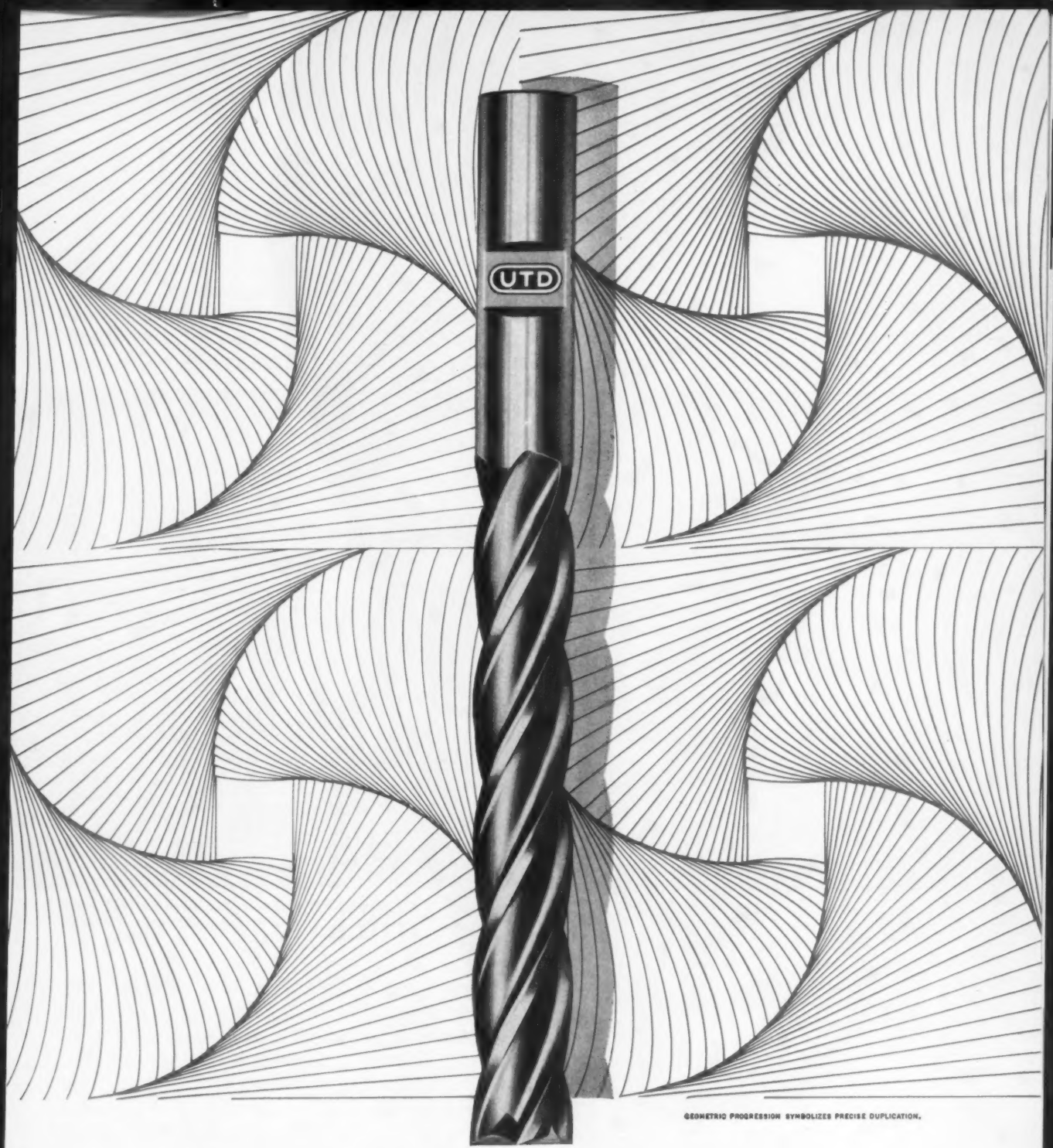


GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION.

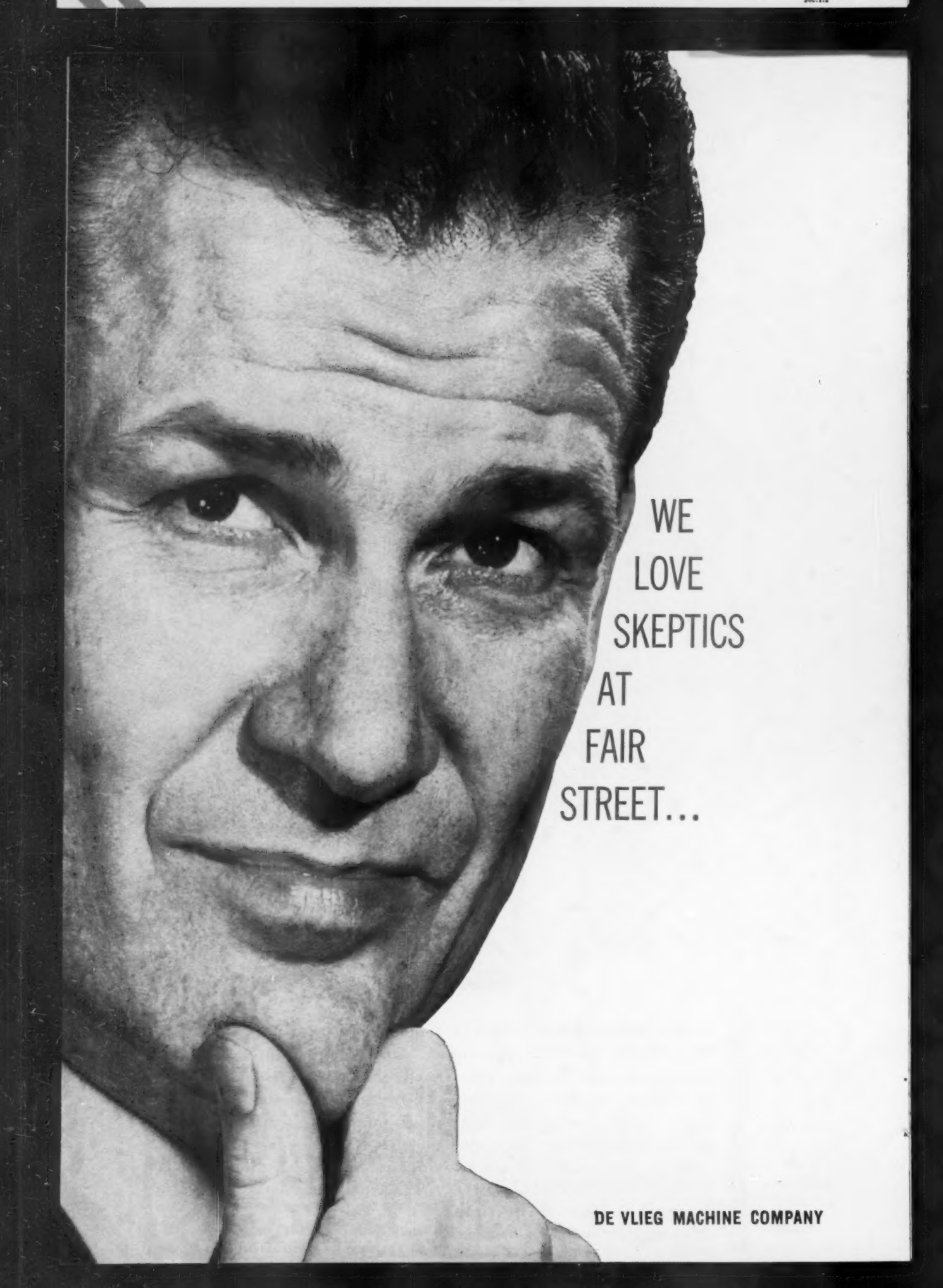
DRILLS
REAMERS
MILLING CUTTERS
END MILLS
GEAR CUTTERS
HOBS
CARBIDE TOOLS
INSERTED BLADE CUTTERS

UTD

FOLLOWING A PATTERN of geometric progression, Union cutting tools of the same type and size are exactly duplicated . . . in quality, dimensions and precision performance. They are calculated to cut costs . . . your costs . . . in the widest range of cutting tool operations. UNION distributors and technical service are available nationally. Fully stocked UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco. UNION TWIST DRILL COMPANY, Athol, Massachusetts. Card Div., Athol, Mass. Butterfield Division, Derby Line, Vermont.

UNION

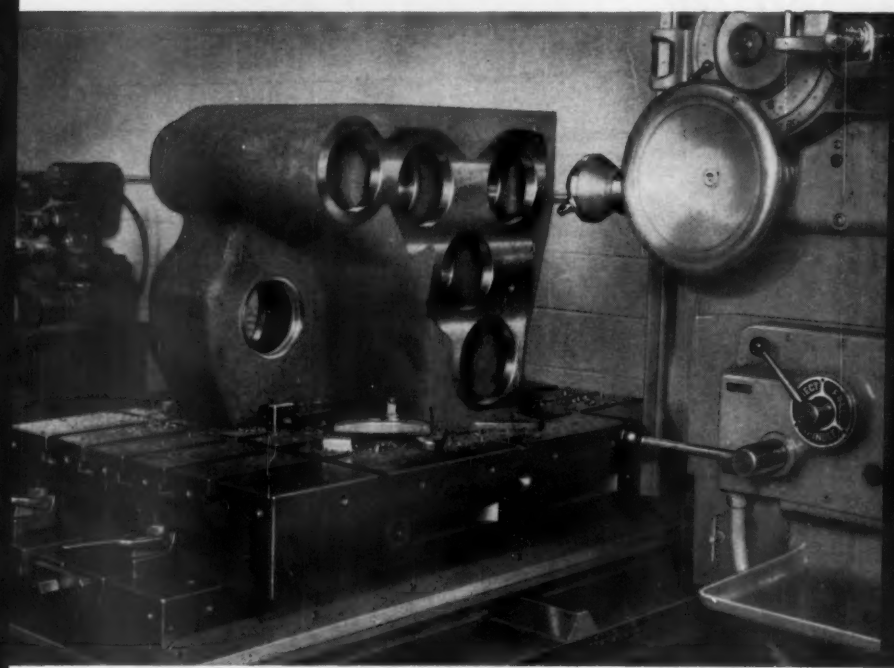
CIRCLE 288 READER SERVICE CARD


WE
LOVE
SKEPTICS
AT
FAIR
STREET...
DE VLIEG MACHINE COMPANY

Of course, everyone who comes to Fair Street for the first time is a skeptic. At least partially so. But we especially like a good healthy skeptic; the man who finds it hard to swallow all he's heard about the proficiency of our JIGMIL and the soundness of the DeVlieg Philosophy of Precision Machining.

SOME OF OUR JIGMIL USERS

AFC Industries, Inc.
Air Reduction Co., Inc.
Alliance Tool & Machine Co.
Amco Incorporated
Bendix Corp.
Besly Welles Corp.
Bethlehem Steel Co.
Burg Tool Mfg. Co.
Buhr Machine Tool Co.
Cessna Aircraft Co.
Cross Company
Farrel-Birmingham Co., Inc.
Gardner-Denver Co.
Gardner Machine Company
Goulds Pumps, Inc.
Harnischfeger Corp.
Hill Machinery Co.
Homogenette Inc.
Hoover Tool & Die Co.



DeVlieg Spiramatic JIGMIL precision bores and mills mining machine transmission housing from two sides on a 180° index.

Basic Principles in the DeVlieg Philosophy of Precision Machining

- A Machine Tool Capable of Desired Accuracies
- Correct Tool Geometry
- A Method of Tool Preparation and Maintenance

Only DeVlieg Delivers the Complete Package!

Hyster Co.
Ideal Tool & Mfg. Co.
Lake Erie Machinery Corp.
Leesona Corp.
Marion Power Shovel Co.
Mason, Shaver & Rhoades Inc.
Midwest Machine & Mfg. Co.
National Electrical Welding Machines Co.
National Mine Service Co.
New Deal Tool & Machine Co.
Paramount Boring & Machine Co.
Paul Machine Tool & Die Works
Quality Tool and Die Co.
R & B Tool Company
Rochester Products Div., GMC
Saginaw Steering Gear Div., GMC
Snyder Corp.
Standard Tool Co.
Vard Div., Royal Industries Inc.
Vogt, Henry Machine Co.

The JIGMIL is one of those things that you've got to see demonstrated to believe. Only by seeing it demonstrated will you know its complete range of capabilities. The accuracies that it routinely achieves. The ease with which it operates. How simple it is to program or control. How easy to maintain. How rugged and durable it is. If you're a good healthy skeptic, why not visit Fair Street! As we've just said, we'd love to have you. After all, some of our biggest skeptics have become our best customers.

WILL YOU BE THE NEXT TO VISIT FAIR STREET

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

FAIR STREET • ROYAL OAK, MICHIGAN

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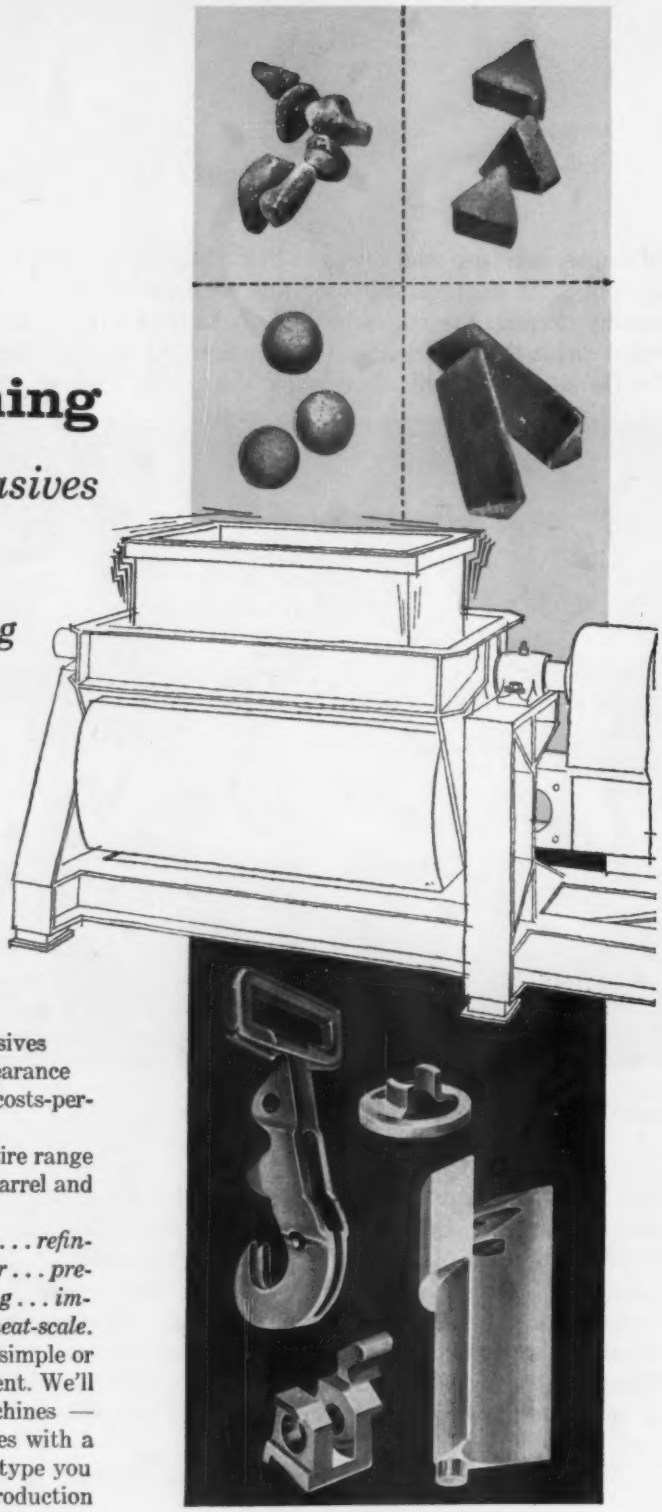
CIRCLE 290 READER SERVICE CARD

Barrel finishing is best finishing

...with TUMBLEX® abrasives

... in every type of rotating or vibratory equipment



Keeping pace with the latest advancements in barrel finishing equipment, Norton TUMBLEX abrasives are first in the field for best results with vibratory machines . . . developed for faster, lower cost finishing of the widest range of parts, especially the most complicated.

The recognized advantages of TUMBLEX abrasives help assure improved product quality and appearance — plus the fastest, easiest way to cut finishing costs-per-piece . . . by this new vibration method.

These advantages are also brought to the entire range of barrel finishing operations of both rotating-barrel and vibration types, including:

Removing burrs . . . smoothing off feather edges . . . refining surface finish . . . burnishing for luster or color . . . preparing surfaces for painting, enamelling or plating . . . imparting matte finish . . . removing dirt, grease or heat-scale.

Send your samples of parts — large or small, simple or intricate — to our Sample Processing Department. We'll barrel finish them on the most suitable machines — vibratory or rotating — and return the samples with a report on the TUMBLEX abrasives and machine type you need to improve product quality and cut production costs. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

NORTON
ABRASIVES
G-409

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

BUCKEYE

SELF-FEEDING AIR DRILLS

LOW-COST HOLES FOR SALE

DRILL, TAP OR FASTEN . . . simultaneously or in sequence. Do it economically with Buckeye self-feeding air tools. Easily mounted . . . small offset, as close as 1¾″ center distance. Adjustable stroke 0 to 2″ with micrometer depth accuracy. Adjustable feed rate. One type features total stroke of 2″ of which 1″ is fully hydraulically controlled . . . also has adjustable rapid approach to cut cycling time. Accessories provide signals to controls which can shut tool off or perform other functions.

Drilling Tool Specifications

Speed Range	900-22,000 rpm
Capacity	1/16″ through 3/16″
Weight	5 1/16 through 5 3/4 lbs.
Length, Overall	16 1/16″ through 21 1/4″

write today for illustrated literature, application studies, templates and prices

BUCKEYE TOOLS CORPORATION

P. O. BOX 966 • DAYTON 1, OHIO

Pioneering power tools for industry since 1920

▲ CIRCLE 292 READER SERVICE CARD

CIRCLE 293 READER SERVICE CARD ►

Tenths to millionths, measure faster with MICRO*trol*® gaging

Lightweight, transistorized; battery or ac powered, MICRO*trol* Type 170

Use this fast, accurate gage at the machine, in production, in inspection, in the laboratory.

It's rugged and lightweight because it's transistorized. Four interchangeable gage heads readily cover the whole range of normal gaging setups.

FEATURES: Weight only 3 lbs. Easy to operate; just 2 knobs. Two dual range models: ± .0003 to ± .003; or ± .001 to ± .010. Pocket sized. Accurate. Basic gages from $341.

Your first step to automatic quality control of machine tool production is MICRO*trol* Type 160

With this complete family of electronic equipment you can range from fast and accurate measurement of dimensions on the bench to complete control of manufacturing in the plant.

With accessories you can get automatic inspection, automatic sorting, or complete closed-loop control.

FEATURES: 4 scale ranges available. Repeatability to 0.000005". High stability and reliability. Comparator systems from $764.

Now with new motor drive Transistorized METRO*surf* Type 180 measures surface roughness at less cost

METRO*surf* is the low-cost, high accuracy way to end the hazards of measuring surface roughness by touch or sight.

It's fast. It's portable. You can use it at machine or bench. Battery or ac models available.

FEATURES: 5 range selections; 3 to 300 microinches full scale. Big dial. Motor-driven or hand-held tracer. Amplifier and tracer head, $495.

CONTROL
CUTLER-HAMMER
AIL DIVISION

These Cutler-Hammer systems and gages hold metalworking to precise tolerances AUTOMATICALLY

To reduce inspection time and cost, Cutler-Hammer supplies the precision metalworking industry a range of gaging and control devices whose building block concept provides great versatility.

You can start with a MICRO*trol* gage or an INCHWORM motor. Then or later, you can add from a choice of accessories. These allow you to inspect, sort, reject, record quality . . . correct machine tools and stop them from making scrap . . . *completely automatically.*

These gages and systems are products of a company that's a leader in advanced military and space electronics, vastly experienced in control for industry. The science is there. The engineering is there. The reliability is there.

You'll be interested in the accuracy, the speed, the inspection and production savings. Contact a Cutler-Hammer sales office, check the publication inquiry number, or mail the coupon today for complete information. Gaging inquiries will be handled by gaging specialists.

Get more accurate production, fewer rejects with INCHWORM Type 202

Centerless grinders are freed from backlash, can maintain required tolerances in a way that will amaze you, when INCHWORM replaces the lead screw!

INCHWORM's ability to move either direction in microinch steps increases production as well as accuracy.

With automatic inspection and simple logic systems, INCHWORM will correct any off-dimension trends automatically. A virtual end to grinding scrap!

FREE TRIAL. Retrofit an INCHWORM to your grinder at our expense. Count your savings during the trial. Then prices start at $3,400 . . . usually quickly recovered.

WHAT'S NEW? ASK...

CUTLER-HAMMER

AIL Division, Deer Park, L. I., New York

Send FREE literature on ☐ Type 170 MICRO*trol* ☐ Type 160 MICRO*trol* ☐ METRO*surf* ☐ INCHWORM

Please check ☐ Send literature only ☐ Have a representative contact me

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ARMSTRONG

TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.

INDUSTRIAL DISTRIBUTORS · THE RIGHT HAND OF PRODUCTION

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

◄ CIRCLE 294 READER SERVICE CARD

▲ CIRCLE 295 READER SERVICE CARD

Another Special by Cross

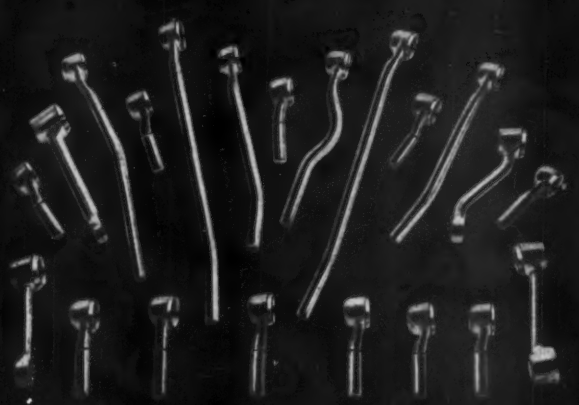
FLEXIBILITY
to process 25 different parts

Flexibility is featured in this Cross machine. One machine processes a variety of 25 different parts. The key to this flexibility is the fixture which holds any one of these varied parts with simple adapter changes.

The machine produces 675 pieces per hour and automatically unloads them onto a conveyor.

An improved chip and coolant system includes a conveyor that reaches right into the machine to remove the stringy chips.

The flexibility and efficiency you require is available in special machines by Cross.



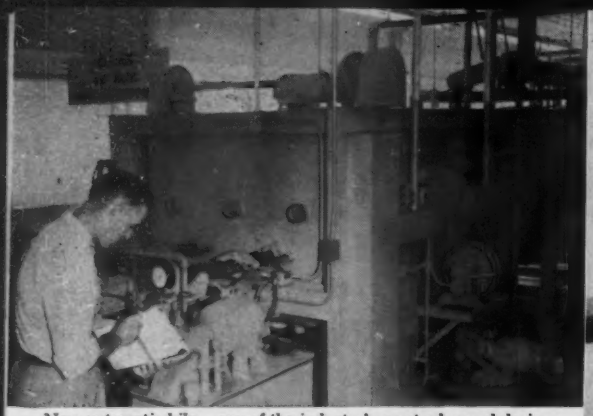
Established 1898

THE CROSS CO.

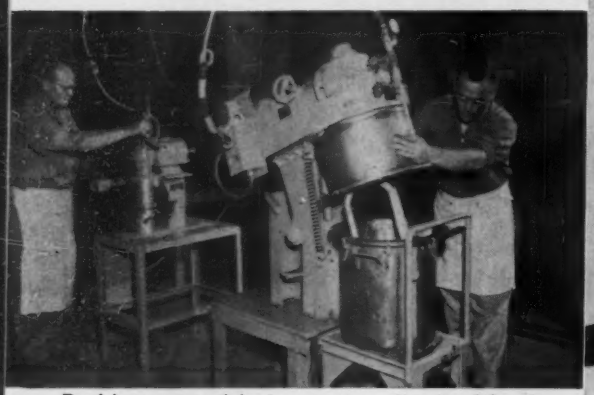
First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

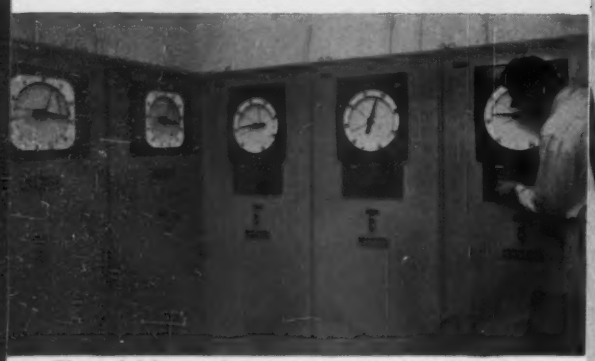
CIRCLE [illegible] READER SERVICE CARD



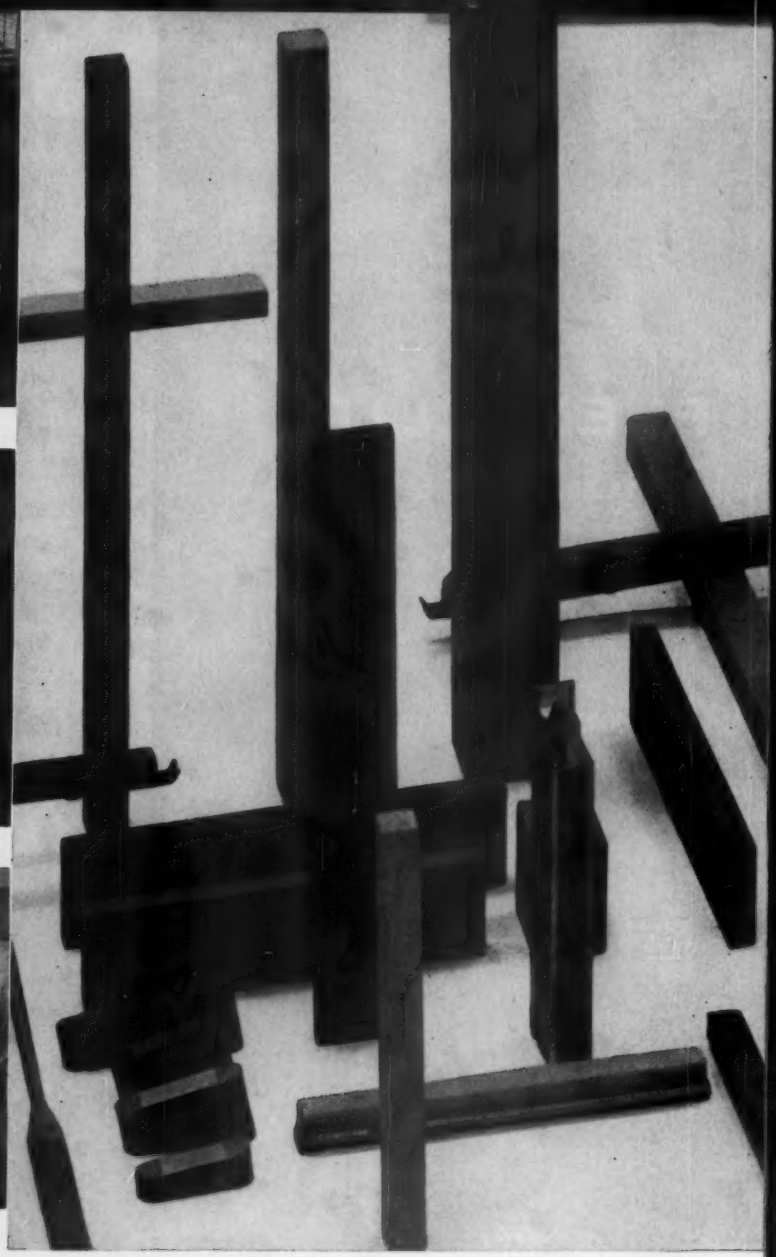
New automatic kiln—one of the industry's most advanced designs.



Precision vacuum-mixing to guarantee uniformity of the mix.



Electronic kiln controls, housed in special, air-conditioned room.



NEW TECHNIQUES unfailingly

Bay State has perfected a completely new process for the manufacture of honing stones which *improves performance* . . . and ensures *more perfect duplication* than has ever been possible before. Result: Honing stones that set entirely new standards for uniformity of texture, hardness and even color . . . stone after stone after stone.

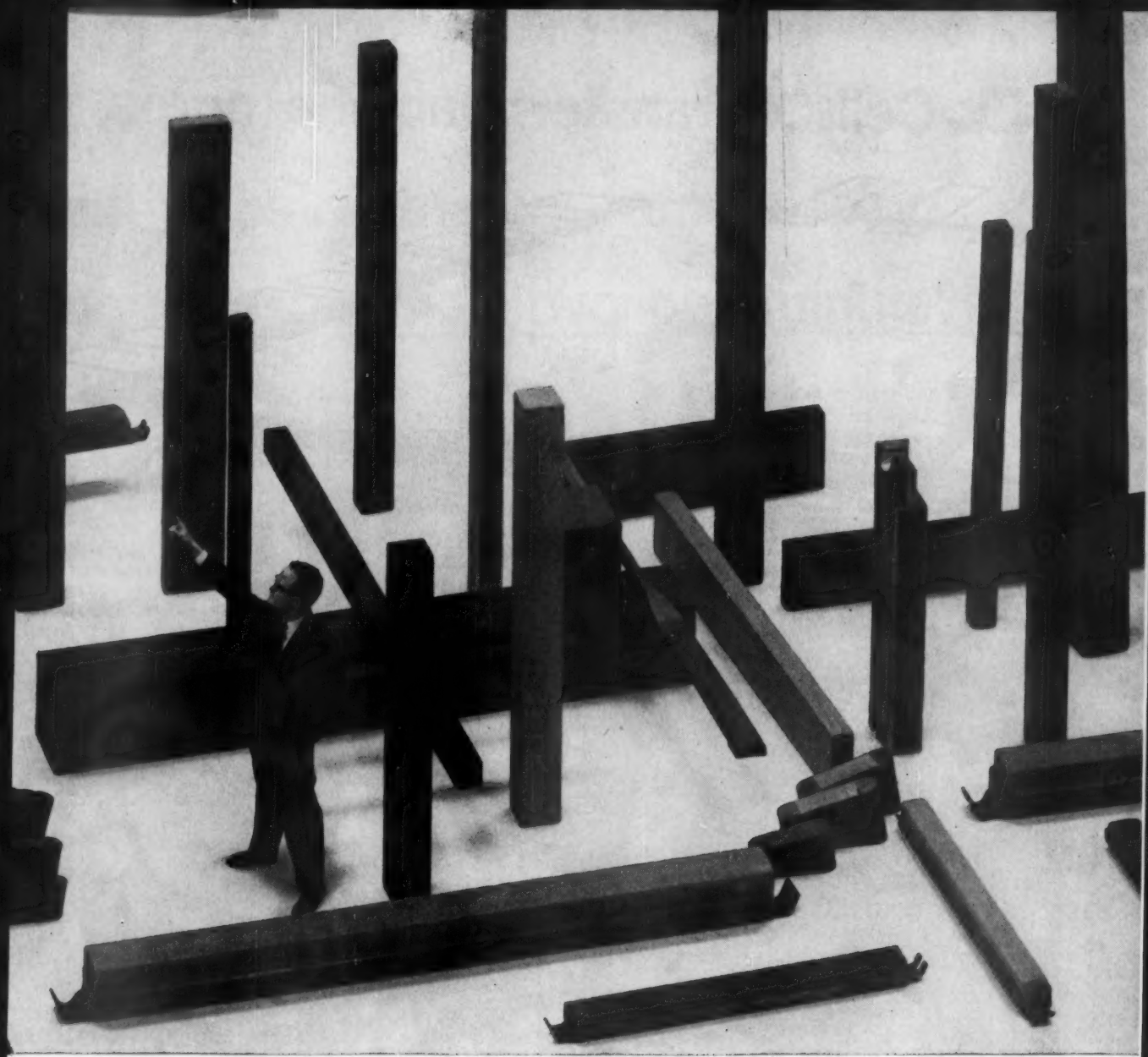
The process starts with the formulation of new bond-abrasive mixtures that ensure uniform dispersion of *all* elements throughout the entire mix. Next comes vacuum mixing: high vacuum in the mixing chamber forces even microscopic bubbles out of the mix and rigid temperature control further guarantees uniformity of the mix.

Final step is firing in the most efficient, automatic kiln yet developed. Even the chemical composition of the atmosphere inside the kiln is controlled by an exothermic gas generator which maintains exactly the combination of gases that best suits the stones being fired.

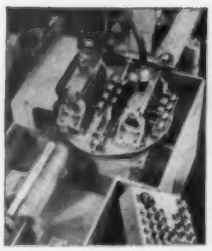
BAY STATE WHEELS of PROGRESS

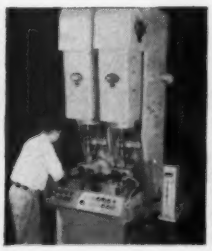
BAY STATE

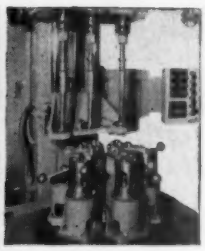
CIRCLE 297 READER SERVICE CARD



duplicate the finest honing stones ever







Production runs of Bay State's new-process honing stones have been exhaustively tested on Bay State's own, in-plant honing equipment ... *and* on every leading type of machine, such as the MICROMATIC, JES-CAL and BARNESDRIL machines illustrated above. *Ask your honing stone supplier for Bay State's new-process stones.*

ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Mass.

Please send me your new 28-page Honing Stone catalog, that specifies which stones work best on what metals and alloys . . . explains how to speed stock removal, improve finish, lengthen tool life, reduce reject rate.

Company _____

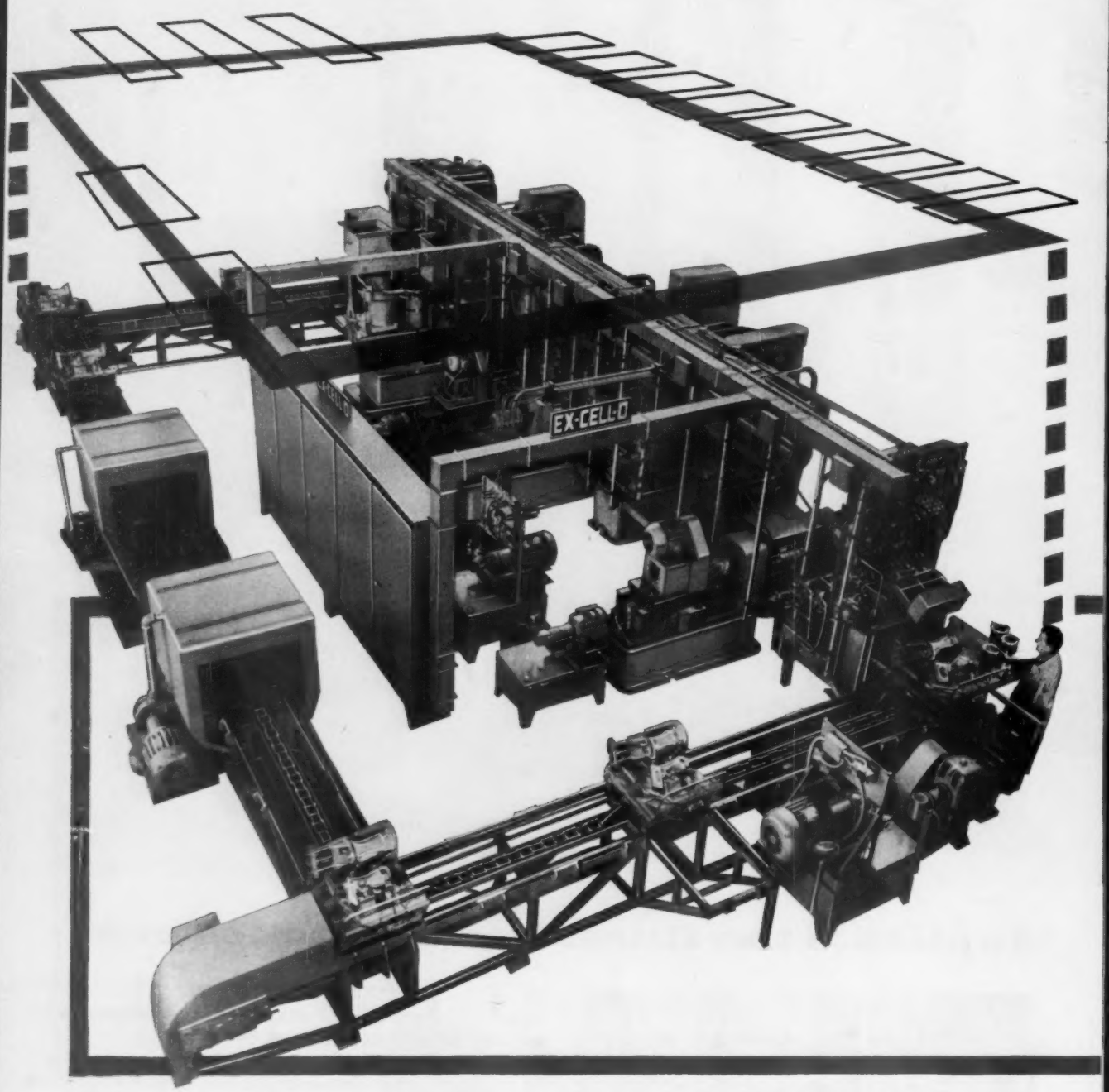
Name _____

Address _____

City _____ *State* _____

CIRCLE 298 READER SERVICE CARD

Ex-Cell-O Transfer Machine bores,



1 Unload, reload, load. Left and overhead: air-operated nut-runners.

2 Left: rough bore, counterbore, chamfer O.D. Right: rough bore, turn, face.

3 Left: idle. Right: drill two .265″ holes vertically.

4 Left: idle. Right: probe two holes drilled at Station 3. Core-drill and spot-face one hole vertically.

5 Left: drill four 25/64″ holes. Right: drill two 21/64″ holes, combination drill and ream two .328″ holes.

6 Left: finish bore, counterbore and chamfer. Right: drill one 13/64″ speedometer lock-screw hole vertically.

7 Left: press in plain bushing. Right: finish-bore, chamfer hole roughed at Station 4.

8 Left: finish bore bushing diameter, finish counterbore. Right: chamfer, form undercut, finish face.

9 Left: idle. Right: tap three 1/4-20 UNC holes vertically.

10 Jet-wash pallet.

11 Blow-off pallet.

12, 13, 14 Unassigned (for future operations).

counterbores, chamfers, faces, drills and taps aluminum transmission units faster than two per minute!

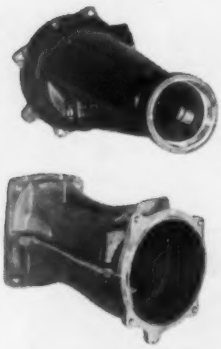
AUTOMATED for high-speed machining—Completely automatic rough-to-finish machining of aluminum transmission extensions is made possible by single-operator control system governing Ex-Cell-O pallet-return transfer system. Output is 124 parts per hour.

PALLETIZED for efficient parts handling—Designed to accept two different components, 18 pallets index in each cycle, carry each part through the machine twice. Parts are loaded, unloaded manually, using power clamp mechanism.

STANDARDIZED for lower initial cost, fast change-over—Spindles, CTW cutting tools, conveyors, torque actuators, worm reduction gearsets, drill bushings and other components are all built by—and backed by—Ex-Cell-O divisions and subsidiaries.

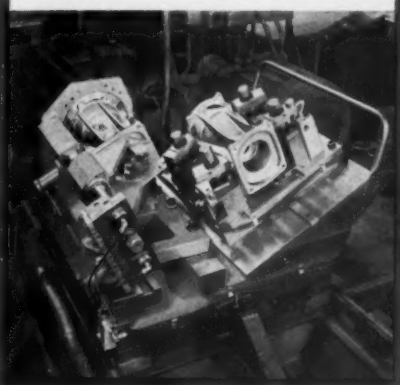
PRECISION-BUILT for unvarying accuracy—Extremely close tolerances are double-checked by inbuilt air-gage stations. Machine holds .0005-inch tolerances on finished bore diameters. Ultra-Precision Ex-Cell-O Spindles are used for all boring operations.

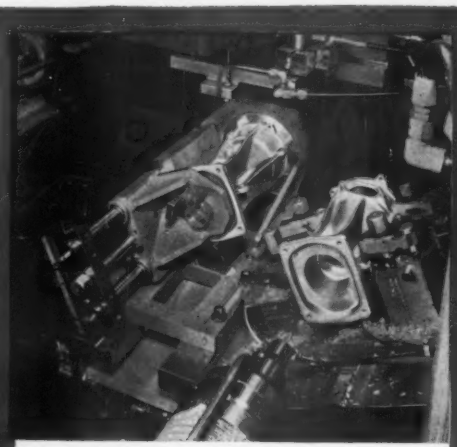
Do you have a large or small part that should be produced faster, more accurately? Your Ex-Cell-O Representative will be pleased to analyze your part or print and show you how an Ex-Cell-O Standard or Special can do the job for you.



Aluminum transmission parts vary in length and shape. Adjustable pallets accept either of parts shown above.

Below, two parts are shown on pallet, oriented 180° to each other. At load station, operator unloads finished part, shifts partially-machined part to empty fixture, loads unmachined casting on opposite side.





At bottom above, Ultra-Precision Spindle uses throw-away tooling. Vertical drill at rear of part at left is driven by Ex-Cell-O Hydraulic Power Unit.

61-28A

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

RETIRED... after cutting 5600 pieces

You can hardly expect more cutting life from a hack saw blade that costs less than $3.00.

This unbreakable MARVEL High-Speed-Edge Hack Saw Blade was removed from a MARVEL Hack Sawing Machine after 9 hours and 30 minutes of sawing—during which time it cut-off 5600 pieces of ¾" round 1112 CR steel. 20 bars were nested and the blade made each cut through the nest in average time of 1 minute and 52 seconds!

Blade cost: 20 pieces for just one cent!

There was no machine down time or shortened blade life due to blade breakage. A MARVEL Blade will eventually wear out—but it won't break. You get every penny's worth of blade life you pay for when you buy *unbreakable* MARVEL High-Speed-Edge Hack Saw Blades.

Regardless of the make of your hack saw machines, you will get more cutting-off efficiency if you use MARVEL Blades. If your hack saw machines are MARVELS, equip them with MARVEL Blades. Together, they are an unbeatable combination.

Leading Industrial Distributors stock and sell MARVEL Blades. Order yours today for more efficient cutting-off tomorrow.

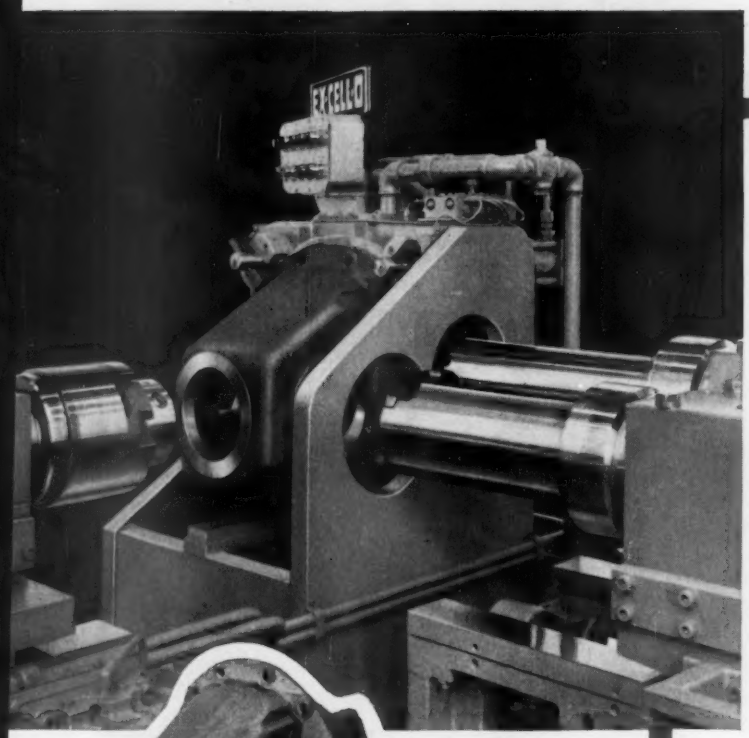
MARVEL *Metal Cutting* **SAWS**

BETTER MACHINES
BETTER BLADES

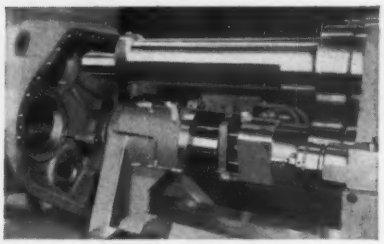
B-1130

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois

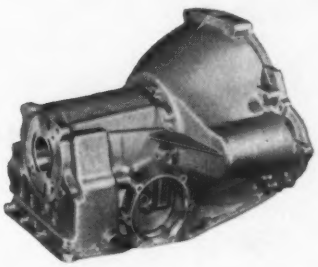
Ex-Cell-O Custom Machines Specialize in Difficult Jobs!



HEAVY-DUTY BORING—Custom Boring Machine uses three heavy-duty Ex-Cell-O Precision Spindles to simultaneously finish-bore four holes and bore-and-face a fifth hole in this 75-pound cast-iron housing in a 4½ minute cycle. Diameters are about 6"; tolerances are held within .001".



MULTI-DIAMETER BORING—In a single cycle, the long boring bar on this Custom Machine line-bores two holes while shorter bar below it bores a third diameter, and small spindle in foreground bores a dowel hole in this huge clutch and gear housing.



HIGH PRODUCTION—Aluminum transmission case shown above is turned 90°, rolled over 180° as it passes through a 24-station Custom Machine. Automatic operations include precision boring, facing, chamfering, radial milling, tapping, trepanning, air gaging and flushing. Output is 124 parts per hour.

Whether you have a simple job that must be done faster and more accurately, or complex work that requires multiple machining operations, an Ex-Cell-O Custom Machine may be just the answer you've been looking for . . . the economical solution to a difficult production problem.

See your Ex-Cell-O Representative, or contact Ex-Cell-O's Machinery Division in Detroit for details on the limitless applications of Ex-Cell-O Custom Machines.

EX-CELL-O FOR PRECISION

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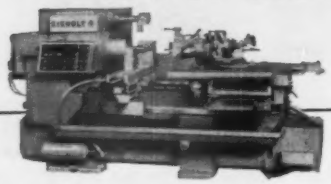
Machinery Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

60-31

ON A GISHOLT AUTOMATIC RAM



Gisholt MASTERLINE Automatic Ram Turret Lathe

From bar to chucking in less than an hour.
Sets up like a turret lathe, uses same standard tools.
Cycle setting learned in a day.
Automatic drill withdrawal for chip clearing.
Internal threading with solid taps.
External threading with self-opening die heads.
Reverse feed and individually adjustable dwell.
16 spindle speeds and infinite feeds—none lost when threading.

Ask your Gisholt Representative for a desk-side demonstration, or write for Catalog 24.

Are you keeping step with new developments in automatic machining? Many of your competitors are—and cutting costs substantially. Even small runs—both bar and chucking work—are now going automatic. How? With the new, fast, easy setup designed into the Gisholt Automatic Ram Turret Lathe. Change-over time is the same as for a hand-operated machine. And—the automatic cycle cuts machining costs 25% to 40%.

To be competitive you *must* go automatic. Why wait? Investigate the Gisholt Automatic Ram—your best answer to the cost profit squeeze.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin, U.S.A.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Factory-Rebuilt Machines with New-Machine Guarantee

New NUMERA-TROL (XLO) Automatically Selects Bore Size and Location!

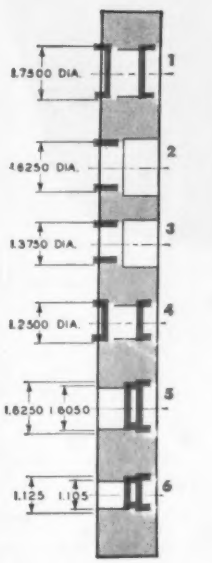
Only Ex-Cell-O's Model 758 Numera-Trol Machine combines a breakthrough in tape-control application with a unique concept in machine design to give you these exclusive production capabilities:

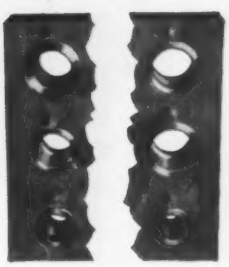
- Automatic pre-selected bore diameter control during machine cycle
- Automatic work positioning for infinite center locations
- Automatic straight-boring, step-boring and counterboring from either end of machine

Using interchangeable boring bars which respond to tape control through a new mechanism developed by Ex-Cell-O, the Model 758 Numera-Trol lets you program variable bore diameters. (Tools are available giving an infinite range of diameters in one-inch increments.) Bore diameters are controllable within .0005", bore depth is controllable to plus or minus .0005".

Infinite bore locations, accurate within .0002" of true center, are possible within the Model 758's 10-inch cross slide and vertical slide strokes.

Infinite, too, are the Model 758's applications. Your Ex-Cell-O Representative can give you complete details, or write direct for Bulletin 506015.





On this workpiece, tape-controlled sequence is programmed from largest to smallest diameters; automatic boring bar adjustment is made at the end of each stroke to eliminate drawback lines. Model 758 holds concentricity within very close tolerances.

60-84

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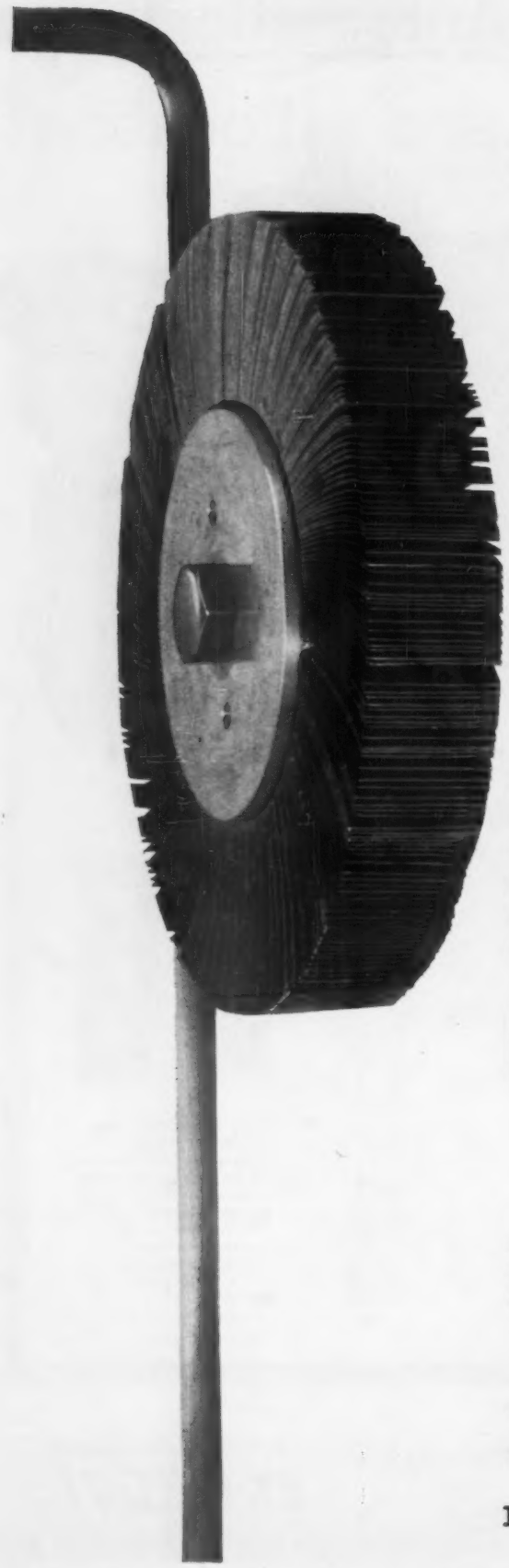
Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN



3MAGINATION in GRINDING and FINISHING

"PG" WHEEL REDUCES FINISHING TIME 50%

Stainless steel sink frames, manufactured by R. D. Werner Co., Inc., Greenville, Pa. are satin finished in half the time using the "PG" Wheel. Recommended by a 3M representative to replace a previous method, this unique 3M abrasive tool has practically eliminated rejects while producing a more consistent final finish.

COST CHECK 5-4-5 **Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase production. Discover . . .**

- If your grinding can be done more economically
- If your finishing is as efficient as possible
- If your polishing can be done faster and better

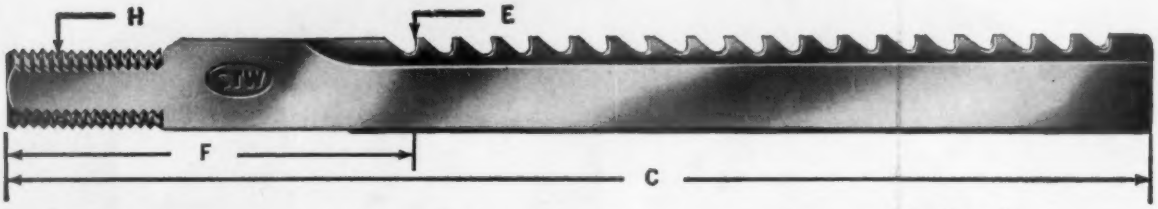
Send today for a free COST CHECK 5-4-5 Review Form without obligation. Put 3M's years of abrasive know-how at your disposal. Write: 3M Company, 900 Bush Avenue, St. Paul 6, Minn. Dept. AAA-121.

3M COATED ABRASIVES

"3M" AND "PG" ARE REGISTERED TRADEMARKS OF 3M CO., ST. PAUL 6, MINN.

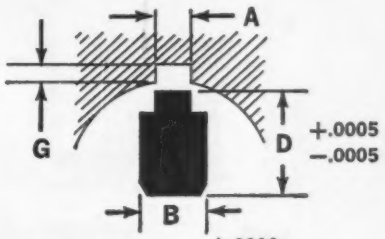
MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW

CTW Keyway Broaches in Stock NOW for Immediate Delivery!



Continental now stocks a popular range of standard keyway broaches to help you meet production schedules faster than ever, and to let you cut your tool inventory.

Just call your CTW Representative, or order by catalog number direct from Continental. The broaches you need are in stock now—ready for immediate delivery to your plant!



Sizes listed below are available for immediate delivery. See the CTW Catalog for other standard broaches. Special sizes quickly made to order. Send your print for a prompt quotation.

BROACHING INDUSTRY SERIES

Catalog Number	A Keyway Width Nom. Dim.	Decimal Dim.	Tolerance	Min. Hole Size	Min.† Length Cut	Max. Length Cut	Width of Body B	Total Broach Length C	Height at Last Tooth D	Height at First Tooth E	Length of Shank F	Keyway Depth in Part G	No. of Cuts	Thread H
502	3/32	.0948	±.0002	7/16	½	1½	.1865	24	.367	.309	8¼	.058	1	5/16-18
504	⅛	.126	±.0002	½	½	1½	.249	30	.438	.364	9	.074	1	⅜-16
505	⅛	.126	±.0002	11/16	⅝	2½	.3115	36	.594	.520	10	.074	1	½-13
508	3/16	.1885	±.0002	11/16	⅝	2½	.374	36	.581	.476	10	.105	1	½-13
512	¼	.251	±.0002	11/16	⅝	2½	.374	36	.612	.476	10	.136	1	½-13
513	¼	.251	±.0002	1	11/16	4	.499	45	.877	.741	11 13/16	.136	1	⅝-11
514	¼	.251	±.0002	1 7/16	⅞	6	.624	51	1.250	1.114	13½	.136	1	¾-10
517	5/16	.314	±.0002	1	11/16	4	.499	45	.908	.741	11 13/16	.167	1	⅝-11
519	⅜	.3765	±.0002	1 1/16	11/16	4	.499	45	.938	.739	11 13/16	.199	1	⅝-11
520	⅜	.3765	±.0002	1 5/16	⅞	6	.499	54	1.189	.990	13½	.199	1	⅝-11
523	½	.5015	±.0002	1½	11/16	4	.624	48	1.312	1.051	12	.261	1	¾-10
524	½	.5015	±.0002	1½	1	8	.624	48	1.377	1.246	16½	.261	2	¾-10
ORIGINAL CTW SERIES														
CTW 7	3/16	.1885	±.0002	11/16	½	2½	.375	36	.581	.480	9	.101	1	½-13
CTW 10	¼	.251	±.0002	11/16	⅝	2½	.375	38	.612	.480	9	.132	1	½-13
CTW 11	¼	.251	±.0002	1	11/16	3½	.500	44	.877	.740	10	.137	1	⅝-11
CTW 14	5/16	.3135	±.0002	1	11/16	4	.500	46	.908	.740	10½	.168	1	⅝-11
CTW 17	⅜	.376	±.0002	1 1/16	11/16	4	.500	46	.938	.740	10½	.198	1	⅝-11
CTW 23	½	.501	±.0002	1½	11/16	3½	.625	46	1.422	1.160	10	.262	1	¾-11
ORIGINAL XLO SERIES														
XLO 3	3/16	.1885	±.0002	13/32	13/32	1¾	.250	28	.541	.438	8¼	.103	1	⅜-16
XLO 5	3/16	.1885	±.0002	⅜	⅜	2	.375	28	.541	.438	8½	.103	1	½-13

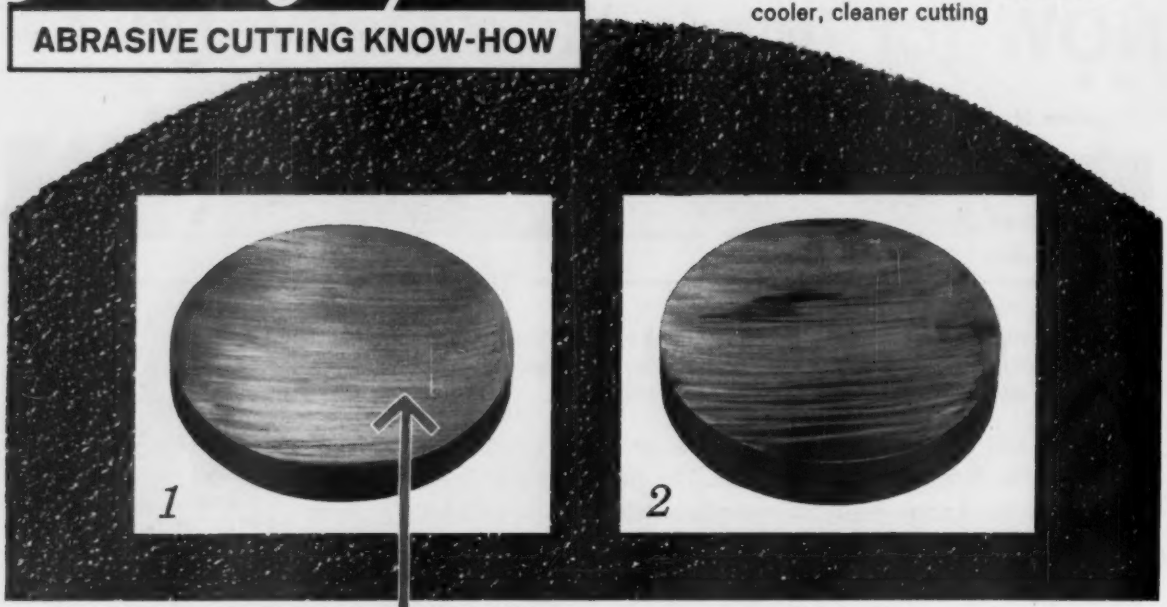
†MINIMUM LENGTH OF CUT RECOMMENDED TO PREVENT PART FROM DROPPING BETWEEN TEETH OF BROACH

61-33C

Continental CTW TOOL WORKS DIVISION OF EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

Allison-Campbell

ABRASIVE CUTTING KNOW-HOW



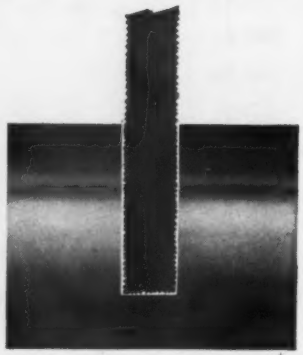
Close-up view of resinoid wheel shows rough texture that provides cooler, cleaner cutting

This CLEAN cut was made with a ROUGH-SIDED wheel!

1 • **THE SPECIMEN ON THE LEFT ABOVE** was cut from a 3¾" diameter hardened steel bar in just 28 seconds with an ALLISON *rough-sided* dry abrasive cutting wheel like the one shown in the background. Note that the cut is clean and practically burn-free.

2 • The specimen on the right was cut under the same conditions and with a wheel of the same formulation, but *without* rough sides. The result—the cut took 30 seconds and produced a badly burned surface.

3 • The secret is the extra clearance the rough sides give *inside* the cut (as shown in the small picture at right), and the resulting *cooler* cutting action. This adds to wheel life, too. That's why, for the dry abrasive cutting of solid bars, heavy-wall tubing and structural shapes, ALLISON-CAMPBELL field engineers generally recommend rough-sided wheels.



3 Inside the cut, rough-sided wheels give extra clearance, extra cooling for faster cutting and to prevent burning

For dry cutting of thin-wall tubing with minimum burr, a fine-grit, *smooth-sided* wheel is the choice. And for *wet* abrasive cutting, dozens of ALLISON wheel specifications are available to match the material you are cutting, the quality you require, and the cut-off machine you use.

Regardless of your cut-off problems, your ALLISON-CAMPBELL field engineer can help you choose the wheels that will give the results you want. He is an abrasive cutting specialist—use his know-how.

***Write** for* **Bulletin DH-214A** *for details on the complete line of ALLISON wheels*

ACCO

ALLISON ABRASIVE CUTTING WHEELS

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

Built by EX-CELL-O

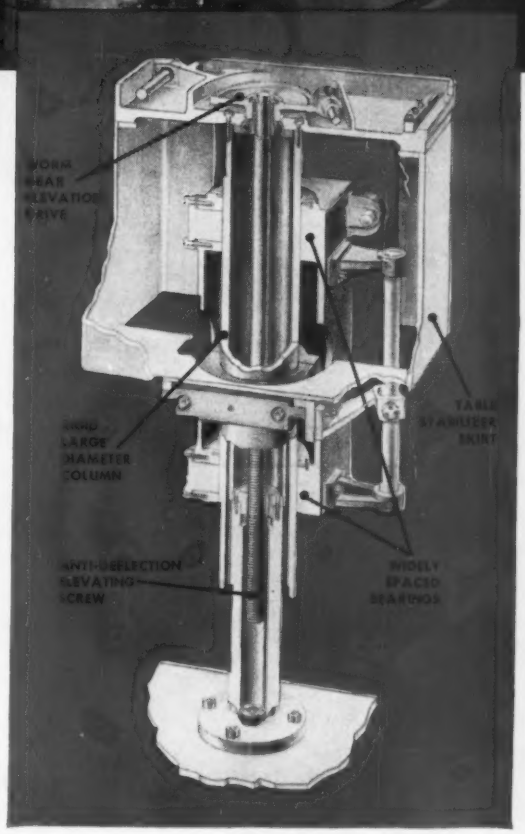
To Insure Accuracy

Rugged, precision construction of Ex-Cell-O Contour Projectors results in stable support for the optical systems providing accuracy in the order of .0001″. This rigidity is a major consideration in achieving for Ex-Cell-O Projectors an outstanding record of trouble free operation and almost total elimination of down time.

Typical of the sturdy, precision workmanship to be found throughout Ex-Cell-O Contour Projectors is the worktable of the Model 14-5 and Model 30. Engineers will recognize the superior design features shown in the inset at right. To cite just a few, the large 5″ O.D. columns, supported in widely spaced bearings; the heavy channel skirt to stabilize the table assembly and the flexible elevating screw which can't impart deflections to the column.

Because of these construction features Ex-Cell-O Contour Projectors support heavy loads firmly, yet move easily and smoothly.

Whether your problem involves receiving, production or final inspection there's an Ex-Cell-O Contour Projector to do the job accurately, quickly and at low cost. The "why" and "how" is condensed in our new booklet—"43 Reasons Why Ex-Cell-O Contour Projectors are the First Choice of Industry." Yours for the asking!



Manufactured by EX-CELL-O Corporation at Detroit, Mich.

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CP61-2

OPTICAL GAGING PRODUCTS, INC.

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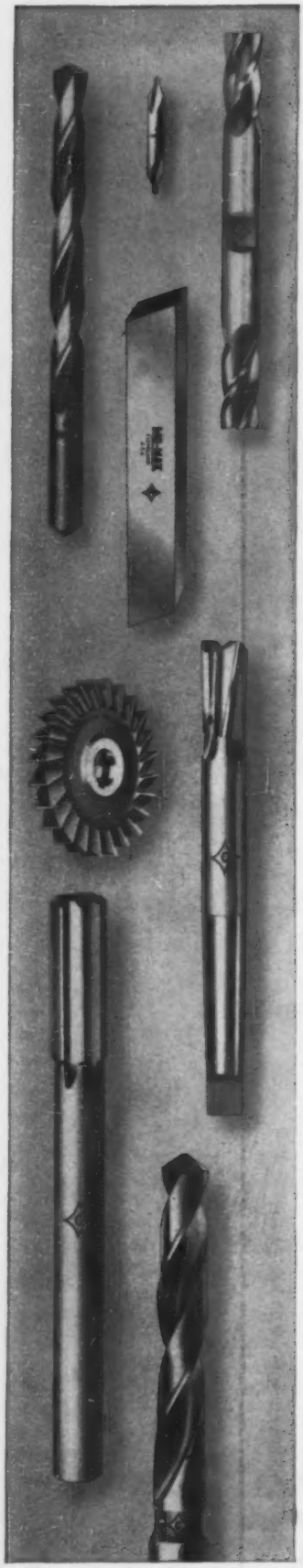
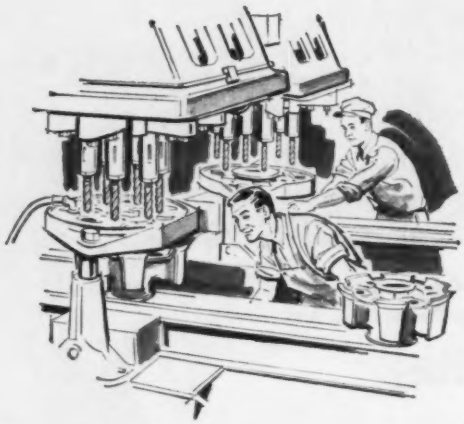
Subsidiary of EX-CELL-O Corporation



Cut your costs with QUALITY TOOLS



CLEVELAND *Quality* Tools are designed and manufactured to

- Cut faster
- Produce more parts per grind
- Reduce costly down-time

Moreover, CLEVELAND *Quality* Tools give you the added benefits of "Teamwork Tooling", whereby the talents of many people are combined to assist in reducing your costs. "Teamwork Tooling" includes not only our engineering skills and modern manufacturing facilities, but also the capable services of our Suppliers, Stockrooms, Service Representatives and Distributors.

THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

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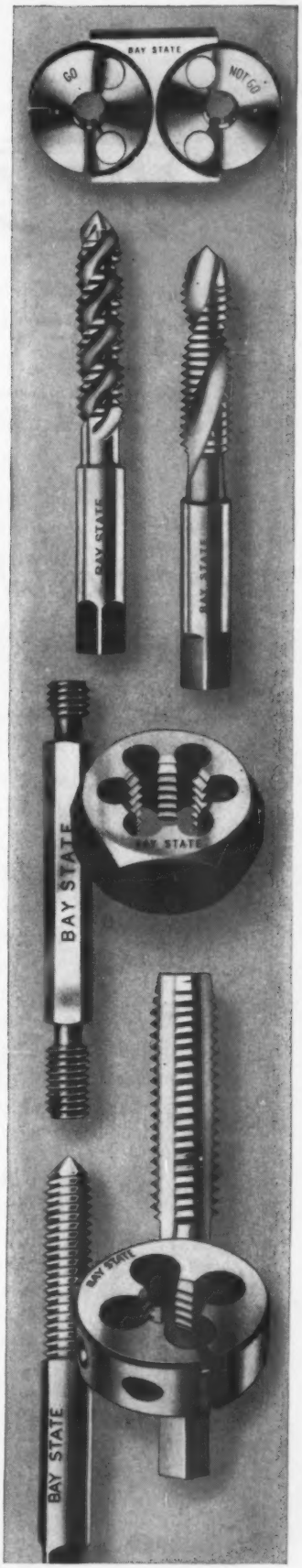
Buy tools on PERFORMANCE and SERVICE ...not on price alone

Strictly on their *superior performance*, BAY STATE Taps, Dies and Gages can help you reduce your costs.

Tools bought on price alone cannot be relied upon for dependability and long wear life. Too often they are the cause of costly down-time and excessive scrap.

You get prompt *service*, too, on BAY STATE Taps, Dies and Gages from your local Industrial Supply Distributor, *plus* our trained Service Representatives operating out of strategically located Stockrooms to help you solve your thread cutting and gaging problems.



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UNIVERSAL models for super accuracy to .0001, high load capacity, perfect for grinding and other high-precision work.

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Over 40 sizes...with all popular tapers... in four styles...to choose from. That's how Ideal helps you meet your turning needs for the heaviest work to the lightest of light jobs.

Ideal Live Centers are guaranteed to provide the highest accuracy required, exactly matching the lathe size you use. What's more, they are custom quality designed and manufactured by production methods to give you the lowest possible precision center point costs.

You can get Ideal Live Centers from your distributor's stocks. He'll give you *immediate delivery service*—which reduces your inventory requirements and cuts your investment costs. If you need a special, we'll be glad to work with him to meet your specifications at the *right* price.

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HOW PROFITABLE IS YOUR SMALL LOT GRINDING?

Grinding a wide range of workparts on a small lot basis can't be done profitably or accurately with toggled up grinding attachments and light-weight machines. It can't be done with machines intended for long run, high-production grinding either.

Profitable small lot grinding depends principally upon rapid job change-over. This requires a versatile heavy duty, large capacity grinder built and tooled to rapidly handle the widest possible variety of grinding jobs. That's why more and more job shops and tool rooms are installing Bryant Universals.

The massive, workhorse construction of the Bryant Universal assures you the same high accuracy of production you get with all Bryant grinders. Mass production methods and spartan design put it well within the economic reach of both large and small plants. Why not let us give you complete details?

EXCLUSIVE FEATURES

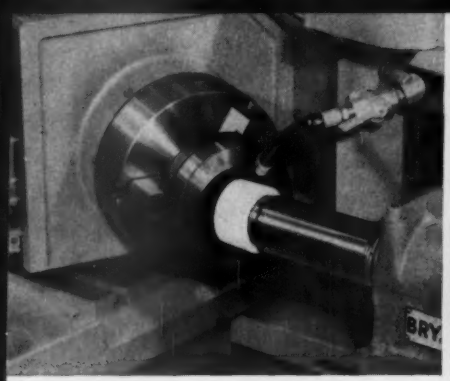
Compound Cross Slide — Locating the cross slide and controls below the traverse slide results in the lightest possible reciprocating mass. Slide sensitivity is increased . . . wear reduced. No moving controls!

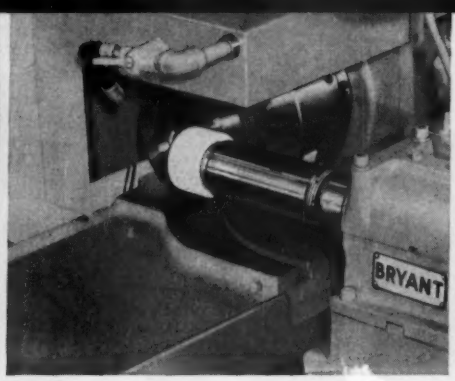
Large Work Capacity — You can swing 16" diameter work within the splash guard . . . handle 23" diameter with guard removed.

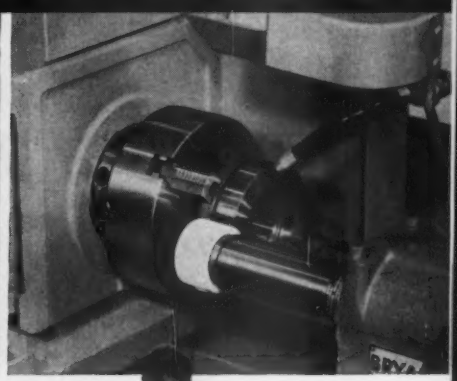
Reversible, Hydraulic Work Drive — Variable speed range from 50 to 500 R.P.M. provides the best grinding conditions for each job.

Multiple Wheel Spindle Positions — Precision T-slot construction permits longitudinal spindle positioning anywhere within a 16" range. This and two lateral wheel spindle positions team with 15½" of cross slide travel for rapid set-up and handling of all jobs.

Cam Lock Spindle Nose — a standard 6" type DL-ASA cam lock spindle nose speeds changing of all standard tool room fixtures.







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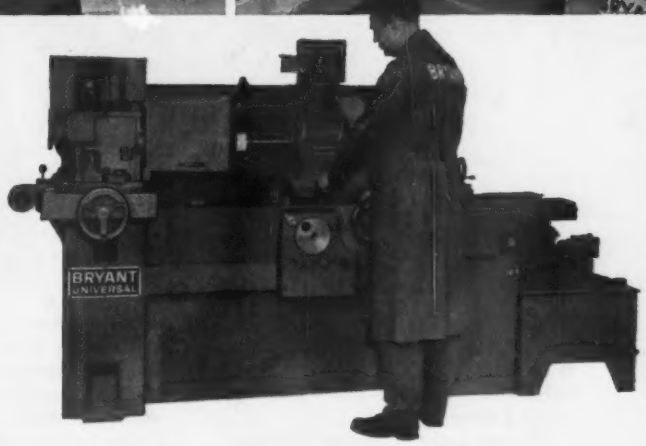

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A "live" demonstration from Brown & Sharpe...

"Let me show how you can save milling machine - by using

...Mr. Kenneth E. Wood, Assistant to Manufacturing

"Your cutters last up to 3 times longer, held on B&S arbors. And the runout is as little as ⅛ the runout you get with other arbors—your accuracy up to 8 times better!

"Sounds hard to believe, but these are honest figures, taken from tests and records comparing Brown & Sharpe and competitive arbors.

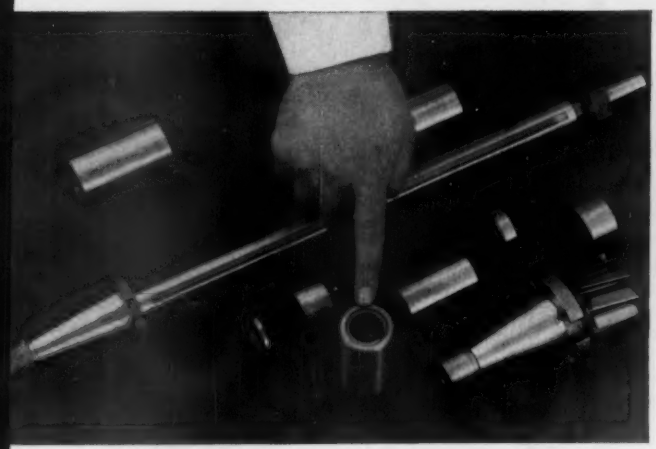
"Milling machines are only as good as the arbors you put in them. Cutting tools are only as good as the arbors you use to turn them. You can preserve machine accuracy, extend cutter life and minimize work rejects by switching to better arbors.

"Look at what you get in Brown & Sharpe arbors. I think you'll agree!

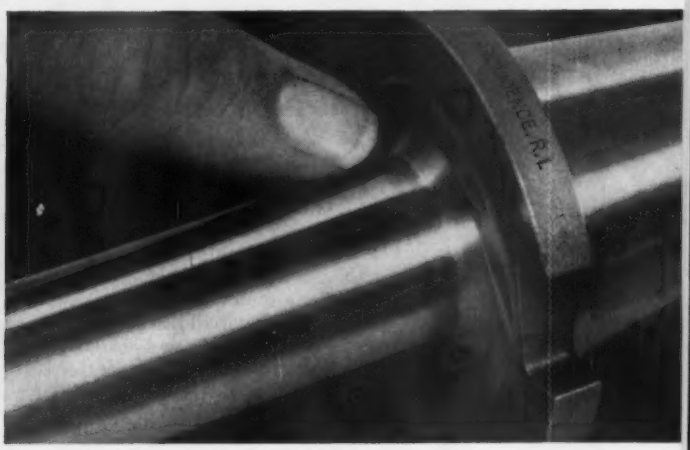
CIRCLE 313 READER SERVICE CARD

money in almost any make of Brown & Sharpe arbors"

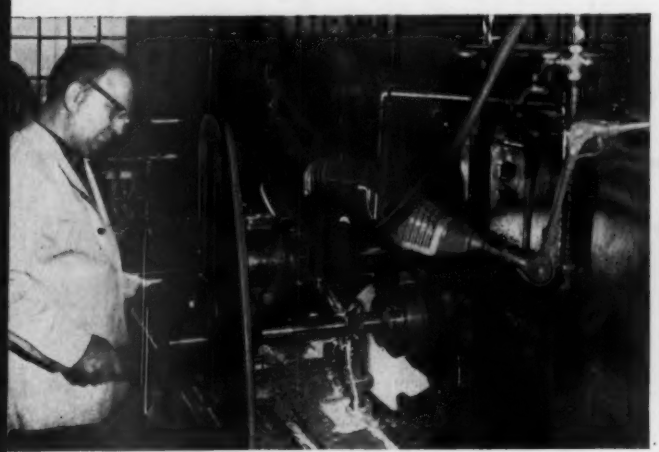
Manager, Industrial Products Division.



"See these faces? They're lapped parallel within .0001" (on Brown & Sharpe's 'Jo-Block' equipment!) Cutters centered by the collars and sleeves won't wobble . . . squareness of the shoulder flange is transmitted right down the line. The arbors are through hardened to approximately 200,000 psi — not just case hardened. All diameters and tapers are precision ground.



"You'll note there's a radius fillet where the shaft joins the shoulder, instead of a sharp corner. It reduces fatigue and flexing, by beefing up the arbor at its most critical point. The extra-fine finish on Brown & Sharpe arbors adds strength, too. Most arbor makers don't bother with these details, but when the chips start to fly, details can make a big difference to you!"



"No matter what makes of milling machine you use — on your production line or in your toolroom — you can usually get B&S arbors to fit them. Brown & Sharpe makes over ninety arbors, with Number 30, 40 and 50 Standard tapers as well as B&S taper shanks. This is the widest line offered by any machine tool builder — a better line backed by Brown & Sharpe's know-how in cutters *and* milling machines.

"For all this quality, you pay no more. That's the surprising part. Brown & Sharpe arbors are priced about the same as other widely used arbors — lower than those offered by other manufacturers of milling machines. You can buy B&S arbors 'bare' — or with collars and sleeves."

Ask your Brown & Sharpe distributor for "the arbors that save money!" Brown & Sharpe Mfg. Co., Providence 1, R.I.

Brown & Sharpe PRECISION CENTER

CIRCLE 314 READER SERVICE CARD

Sundstrand offers you "Engineered Milling Production" with a standard machine line

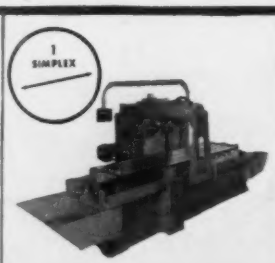
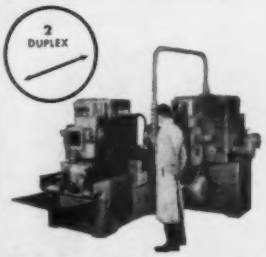
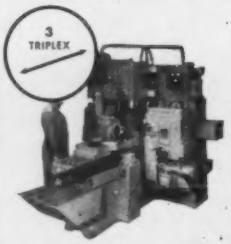
Unit construction provides almost unlimited arrangements, "custom-built" to meet your specific needs

The Sundstrand "Engineered Production" approach to your milling requirements assures you maximum productivity per dollar of machine investment. Sundstrand application engineers evaluate your production and then recommend a machine that will fit your requirements as if it were specially built for the job. This is possible because of the exceptionally wide range of Rigidmil sizes, types, and unit combinations available, as indicated in the table below.

For example, Sundstrand catalogs more than 138 standard Simplex and Duplex machines, plus a wide range of variations. Attachments such as vertical feed to horizontal heads, power feed to quills, automatic index bases, etc., provide additional cycle combinations.

The heads, columns, and tables on C-model Rigidmils are self-contained units, permitting interchangeability through several sizes. There is no need to compromise when you need a machine that isn't quite a standard model, nor do you have to buy more machine than you need. Adding the next size head or table can give you a custom-built installation at minimum cost. And you get extra protection against obsolescence because if your work requirements change, you can modify the machine by changing the head.

To determine how much the right Sundstrand milling machine can save you, send for Bulletin No. 625 and ask about a Sundstrand "Engineered Production" analysis of your production.

custom milling machines *from* standard components	1 SIMPLEX 	2 DUPLEX 	3 TRIPLEX 
HEADS	3 to 100 hp | HORIZONTAL or VERTICAL	3 to 100 hp | HORIZONTAL or VERTICAL	3 to 75 hp | HORIZONTAL and VERTICAL
TABLES Width"	10½ to 96"	10½" to 38"	10½" to 38"
TABLES Feed Stroke"	18" to 216"	18" to 216"	18" to 216"
COLUMNS	FIXED OR CROSS TRAVEL	FIXED OR CROSS TRAVEL	FIXED OR CROSS TRAVEL
CONTROLS	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT

Automatic and Tracer Lathes

Milling Machines

Transfer Machines

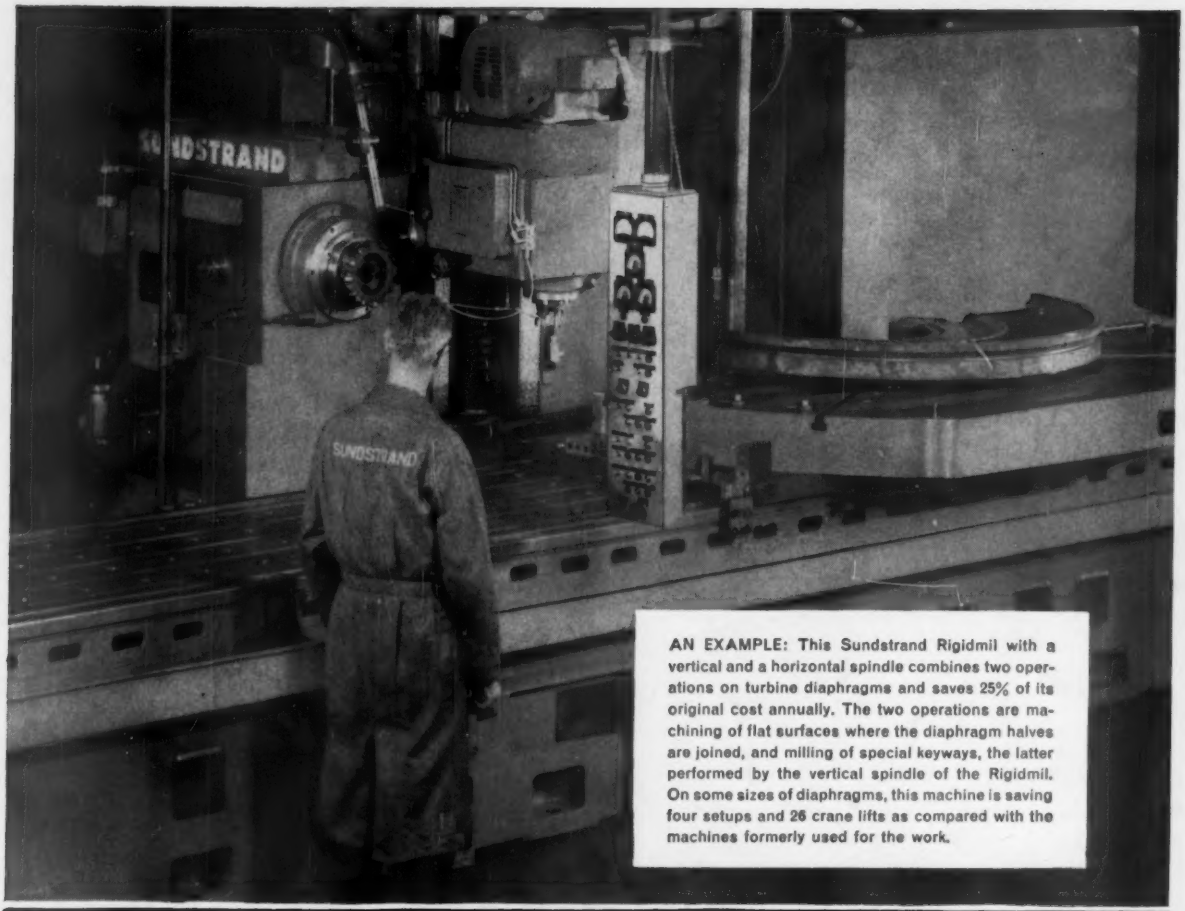
Multiple-spindle Drilling Machines

Belt and Wheel Grinders

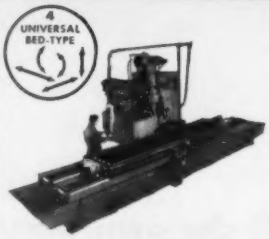
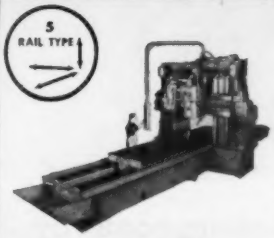
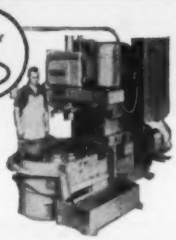
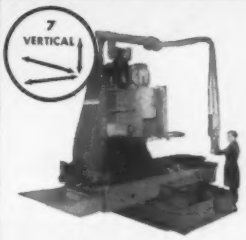
Broaching Tools

Broaching Machines

Thread Milling Machines



AN EXAMPLE: This Sundstrand Rigidmil with a vertical and a horizontal spindle combines two operations on turbine diaphragms and saves 25% of its original cost annually. The two operations are machining of flat surfaces where the diaphragm halves are joined, and milling of special keyways, the latter performed by the vertical spindle of the Rigidmil. On some sizes of diaphragms, this machine is saving four setups and 26 crane lifts as compared with the machines formerly used for the work.

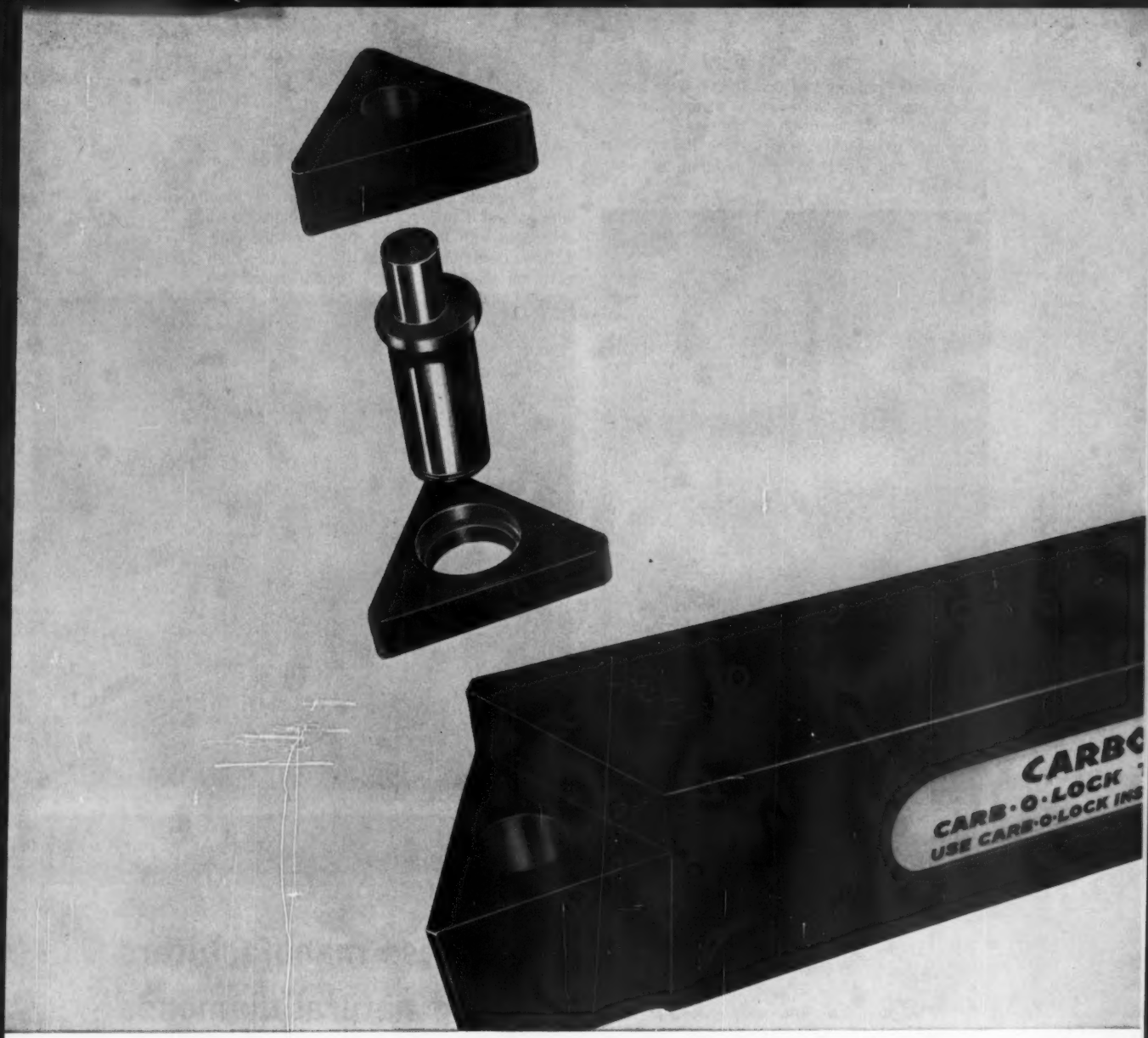
4 UNIVERSAL BED-TYPE	5 RAIL TYPE	6 ROTARY TABLE	7 VERTICAL
			
20 and 50 hp | ALL ANGLE and HORIZONTAL	25 to 50 hp | VERTICAL	25 hp | VERTICAL	50 hp | VERTICAL
24" to 38" 48" to 216"	24" to 60" 48" to 216"	Dia. 36", 48"	30" 96"
CROSS TRAVEL	FIXED	FIXED OR CROSS TRAVEL	FIXED
PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE	PENDANT, TRACER OR TAPE

SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

How to cut your disposable-tooling costs by 30 per cent at no sacrifice in quality or output. (Answer is on the next page.)



With the new Carb-O-Lock toolholder-insert combination. The single most important advance in the whole history of metal-cutting.

Save 30 per cent when you buy it. Save 40 per cent when you use it.

These are minimums. Users of the Carboloy Carb-O-Lock toolholder-insert combination have reported savings many times higher. Why?

Simple. The Carb-O-Lock design is simple. Using a cam-action locking principle, the Carb-O-Lock has just three parts (not including insert). Insert changing and indexing is a breeze; parts inventories can be held to absolute minimums. Streamlined design lets you bring the toolholder closer to your work. And less overhang means less vibration, less insert chipping and breaking.

Plus: the Carb-O-Lock gives you proven performance. A major diesel engine manufacturer discovered Carb-O-Lock allowed nearly triple the feed, eliminating two machines. A locomotive and car equipment company found Carb-O-Lock's simple, rugged design reduced time for tool changes and permitted maximum horsepower utilization.*

Carb-O-Lock inserts are available now in Grade 883 for machining cast iron, as well as many operations on the following materials: high-temperature alloys, type 300 stainless steel, brass, bronze.

So start your savings program today. Phone your Authorized Carboloy Distributor and order your Carb-O-Lock toolholder-insert combination. Save 30 per cent. And more.

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**Case histories available on request*

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METALLURGICAL PRODUCTS DEPARTMENT

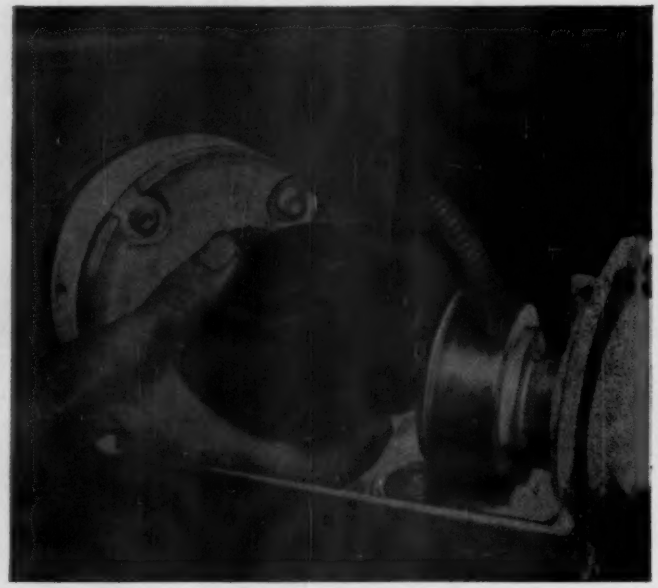
GENERAL ELECTRIC

CARBOLOY CEMENTED CARBIDE BLANKS AND DISPOSABLE INSERTS • BRAZED TOOLS • TOOLHOLDERS • CARBIDE DIES • WEAR PARTS

CIRCLE 318 READER SERVICE CARD

Diamonite® Products Mfg. Co., Shreve, Ohio, gang-grinds ceramic rings with natural diamond wheel. The unchanging dimension of the wheel assures uniformity of diameter and surface finish. Only diamonds can give the finish required to meet specified tolerances.

Bell & Howell, Chicago, grinds 13 lenses simultaneously with natural diamonds. Cup-type metal-bond wheel is impregnated with 160-mesh natural diamond particles. Bell & Howell also uses natural diamonds to polish precision parts for their new "zoom" camera mechanism.



These manufacturers are using natural diamonds to advantage. You can, too.

Industrial diamonds cut practically everything... especially your production costs

National Vulcanized Fiber Company, Wilmington, Delaware, cuts glass-reinforced plastic tubing with diamond cut-off wheel. Metal-bond diamond wheel withstands heavy abrasion of glass reinforcement, and leaves a clean, smooth edge without causing delaminations.

Kandu Tool Company, New Haven, Connecticut, grinds carbide gun drills, used to drill deep holes in steel, with natural diamond resinoid-bond wheel. In this operation, .015" of material is removed in a plunge cut. Only natural diamonds can withstand the impact of the interrupted cut.

The four grinding and polishing jobs shown here span the fields of optics, metalworking and ceramics. But they have one important thing in common: in every case, natural diamonds are doing the job quickly—and economically.

In diamonds, you find this unique combination of properties: excellent cutting ability linked with fantastic endurance.

Result: your diamond tools last longer than any other tools you can use. Your people spend more time producing, less time changing tools.

If you cut, sharpen or smooth in your business, you can probably use natural diamonds to advantage. Test them against the method you're now using. You'll see how efficient—and economical—a diamond can be, especially now.

BEST GRIT FOR METAL-BOND WHEELS DEVELOPED BY THE DIAMOND RESEARCH LABORATORY IN JOHANNESBURG

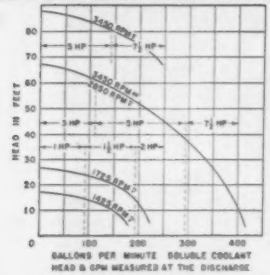
A new impact crushing method for natural diamonds is now producing the strongest and most durable diamond grit ever obtained for metal-bond wheels. Your tool and wheel manufacturer is ready to help you select the diamond tool that's right for your job.

Industrial Distributors (Sales), Ltd.

World's leading supplier of diamonds for industry

Gusher

Coolant Pumps
are
PROVED IN PERFORMANCE



Performance chart is for Model 11025

You can be sure that your GUSHER Coolant Pumps will give you year after year of highly satisfactory service. GUSHER Pumps are built to last the life of the machine they service.

Model 11025 is an immersed type Gusher Coolant pump for installations where deep tanks are necessary.

Model 11024 CM Long for pump installations requiring standard NEMA foot mounted motors to meet J.I.C. specifications. Available in ¼ HP and larger.

Gusher, fully portable, Tank Units are available in capacities from 10 to 50 gallons.

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- CIRCULATORS • AGITATORS
- MOLTEN METAL PUMPS

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LETTER from the PUBLISHER

How New Is It?

One of the most important sections of a good technical publication is its new product department. We consider it so vital that we have an editor who spends full time collecting, sifting and editing data on new products.

It must be new . . .

You have a right to insist that your technical publication report to you accurately on new products when they are new and only when they are new. Some publications run a paste pot operation. Any new product release they receive, they automatically print. This can result in many *old* products being reported as new. It can also result in your being given inaccurate information on product characteristics and performance. This not only wastes your time but may mislead you.

You should be able to count on your technical publication to report to you accurately on new products when they are new. This is why we have a new products editor. His job is to make sure we print no new product information that is not *new*. He sifts and checks the facts for accuracy—often contacting the manufacturer for further clarification or more data. In spite of the large number of new product items we publish in a year, we reject many as not new or as not of primary interest to you.

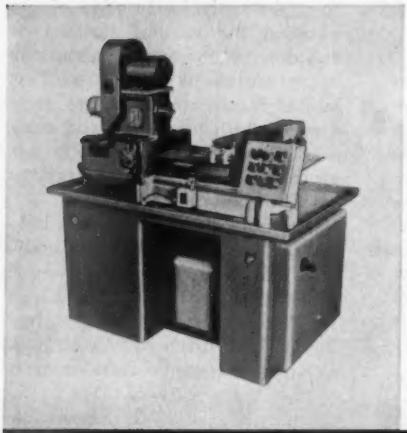
Well organized . . .

Your new product department should be well organized, easy to read. This is why we have separate sections on new materials and new shop equipment and supplies. You will note also that some items are larger than others; some are illustrated; some are not. We do all this to help you get information quickly; to save you time; to make it easier for you to find what you want. We propose to continue doing these things to make American Machinist/Metalworking Manufacturing serve you in every department. Any technical publication that does not do this is not worth your time.

George Reppert

JONES & LAMSON'S *NEW* PRECISION LINE of smaller machines

precision performers in the under $10,000 price range.



MODEL 6 PRECISION BORING MACHINE

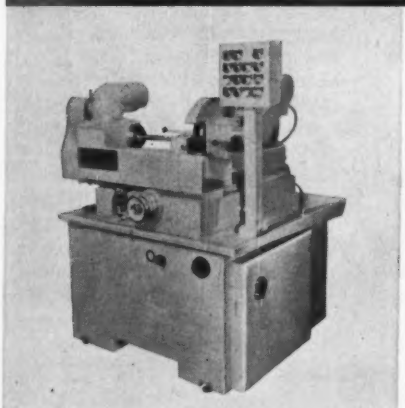
FEATURES:
- choice of three automatic cycles
- push button operation
- varied chucking for rotating either tools or work
- applicable for multiple spindles

write for folder #6016

SPECS:

Swing — 10″ dia. max., Stroke — 7⅝″ max.

Bore — .090″ dia. min., 3″ dia. max.



MODEL 410 PRECISION THREAD GRINDER

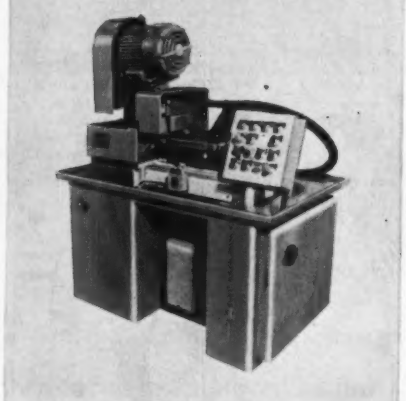
FEATURES:
- stark simplicity in set up and operation — push button control
- pre-packed work and wheel spindles — lubricated for life
- dual lead compensation (short & long)
- all machine slides are on pre-loaded rollers for smooth accurate traverse

write for folder #6015

SPECS:

Work Dia. — 4″ max., Thread Length — 10″ max.

Wheel Speeds — 2700 RPM



MODEL 6D PRECISION GUN DRILLING MACHINE

FEATURES:
- high penetration rates (12″ per min. not unusual)
- automatic cycling — push button control
- spindle distributes 12-15 gals. of coolant per min. at 2,000 PSI
- infinitely variable and constant feed rate

write for folder #6014

SPECS:

Spindle Speeds — 15,000 RPM, Max. Length of hole — 6″, Dia. of hole — ½″ max., .074 min., Stroke — 7¾″ max.

JONES & LAMSON

THREAD TOOL DIVISION

Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vt., U. S. A.

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We cut keyways in one minute — often for less than a penny apiece. Wide range of sizes, too, from 1/16" to 1" in any bore from 1/4" to 3".

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(B) HEXAGON BROACHES
For finishing 1/4" to 1/4" hexagon holes in one pass in cast or drilled bore.

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LETTERS

to the editors

330 W 42nd St, New York 36, NY

Training an Obligation

Dear Sirs:
May I take this opportunity to express my deep appreciation for the mention of my name in your October 2nd editorial (*AM/MM*—Oct 2 '61, p79).

Your views on apprentice training as expressed in this editorial are very well taken and should make it crystal clear to the management of the metalworking industry that apprentice training is not a special right but an obligation.

J Kleinoder
Treasurer
Volkert Stampings, Inc
Queens Village, LI, NY

Pilot Pins

Dear Sirs:
Having carefully studied the reference book sheet, "Pilot Pins for Progressive Dies," (*AM/MM*—Oct 16 '61, p141), I wish to comment on some basic disagreements regarding use and shape of pilot pins.

The purpose of the pilot pin is to achieve precise location of the strip in the various stations of the die, by correcting deviations or variations in feed as well as lateral displacement of the strip due to width tolerances and camber. To minimize wear it is desirable to keep these corrections to a minimum.

The nose of the pilot pin is bullet-shaped (parabolic) not conical, for this geometric shape assures smoother performance with less distortion of the punched hole, which often has to be used again in successive stations or is part of the workpiece. Due to the small corrections carried out, the parabola in pilots over 1/4-in. diameter may be truncated to bring the pilot's starting diameter to about one-half the size of its final diameter.

The amount of correction possible is related mainly to the diameter of the pilot hole, only in a very limited degree to stock thickness. On the other hand, the stock hardness has a distinct influence on the possible action of the pilot. Soft stock, especially when thin, permits slight corrections only in order not to elongate

SHOPMATES

N. Jarvis

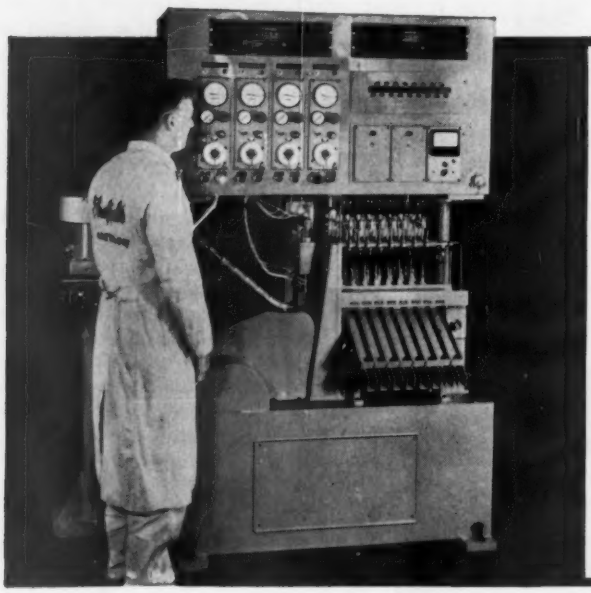
I BEEN HEAT TREATIN' BY THE BOOK FOR TEN YEARS AND I HAVN'T SPOILED NOTHIN YET!!
YEAH!! WELL I WANTA SEE THE COLOR!! IT'S GOTTA' BE A SHADE BETWEEN A RED BANDANNA AND A RIPE TOMATO .... A PLUM TOMATO!
N. JARVIS

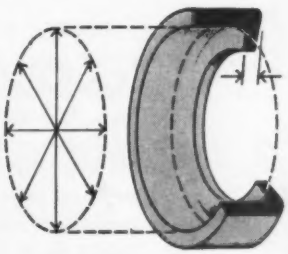
A Sheffield sorter* sorts 2000 rings an hour

2000 rings an hour a Sheffield sorter* sorts.

If a Sheffield sorter* sorts 2000 rings an hour

Where are the 2000 rings the Sheffield sorter* sorts?





*This Sheffield automatic gaging, classifying and segregating machine inspects up to 2,000 rings an hour for the Western Electric Company. It simultaneously measures inside diameter and flange thickness, classifies rings into 15 sizes plus out of tolerance, and rejects each size in its chute. Its speed and accuracy have resulted in appreciable manufacturing savings.

One of them is in your telephone.

Pick it up and call SHEFFIELD for further information on automatic gaging and assembly machines. CL 4-5377, Ext. 211, 212, 213.

The **SHEFFIELD** Corporation — Dayton 1, Ohio

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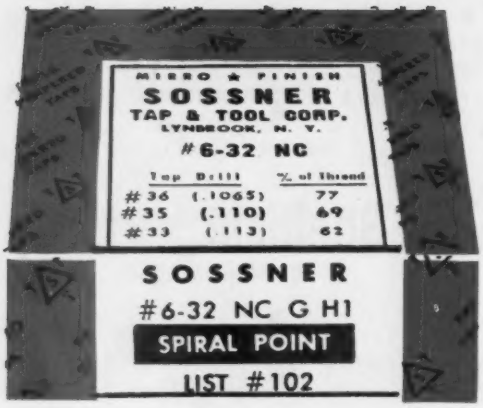

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STT-20-M1

or extrude the pilot hole, which results in incorrect positioning and interference with feed.

It is general practice to set the feed mechanism so that the strip advances 0.002 to 0.005 in. more than the spacing of the stations, and so that the pilot pins push the strip back into correct location. This way, the pilot pins handle the comparatively lightweight, unreeled part of the strip only, and it never happens that the heavy roll of strip has to be turned. Furthermore, a trip lever opens the clamp roll or slide of the feed mechanism just at the moment of entry of the pilot pin, to make easy correction possible.

There is considerable difference of opinion on spring-loading pilots, as well as on the clearance of the pilot in the pilot hole and the pilot bushing in the die block. The advantage of putting a spring with preload of 15 to 20 lb behind the pilot is that, if a misfeed is incorrectable, the pilot will retract and save the die from damage. But it does not stop the press. Therefore a misfeed detector (a microswitch tripped by the retracting pilot) is advisable to shut off power to the press. Often a compromise is made, and only the pilots in delicate bending stations are spring loaded, the rest being rigid.

Pilots in the final blanking punch have one distinct disadvantage. They tend to pull the part out of the die, in which case pushoff pins have to be used. This problem can be completely avoided by putting the pilots in the scrap strip.

Oscar Loeffler
Newark, NJ

AM/MM

"Of course I had to change the print."

CALENDAR

Society of Automotive Engineers —Annual Meeting and Display, Jan 8-12, Cobo Hall and Convention Arena, Detroit, Mich

Joint National Symposium on Reliability and Quality Control, Jan 9-11, Statler Hilton Hotel Washington, DC.

Society of Plastics Engineers—Annual Technical Conference, Jan 30-Feb 2, Penn-Sheraton Hotel, Pittsburgh, Pa.

Material Handling Institute — Spring Meeting, Feb 6-8, Hilton Inn, Atlanta, Ga.

American Society for Metals — Golden Gate Metals Conference, Feb 15-17, Fairmont Hotel, San Francisco, Calif.

Society of Automotive Engineers — National Automobile and Production Meeting, Mar 12-16, The Sheraton Cadillac, Detroit, Mich.

Pressed Metal Institute—Spring Technical Meeting, Mar 14-16, Commodore Perry Hotel, Toledo, Ohio.

Society of Automotive Engineers —National Aeronautic Meeting and Display, Apr 3-6, Hotel Commodore, New York, NY.

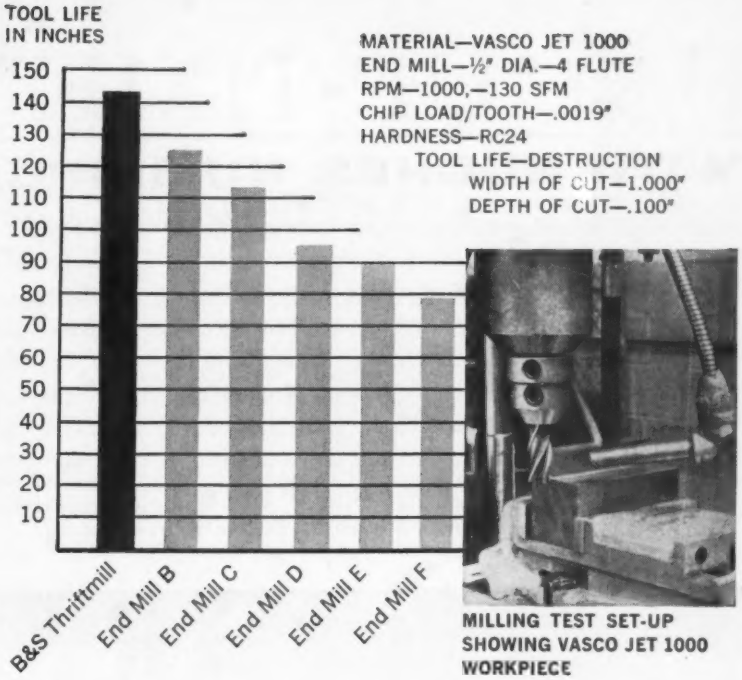
American Welding Society — Annual Convention and Exposition, Apr 9-13. Technical Meetings, Sheraton Cleveland Hotel; Welding Show, Cleveland Public Auditorium, Apr 10-12, Cleveland, Ohio.

American Foundrymen's Society —Castings Congress and Exposition, May 7-11, Cobo Hall, Detroit, Mich.

American Institute of Industrial Engineers — National Conference, May 17-19, Ambassador Hotel, Atlantic City, NJ.

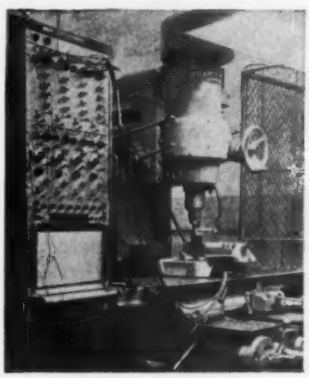
Society of Automotive Engineers —Summer Meeting, June 10-15 Chalfonte-Haddon Hall, Atlantic City, NJ.

American Society for Testing Materials — Annual Meeting and Exhibit, June 24-29, Statler Hilton Hotel, New York, NY.



MILLING TEST SET-UP SHOWING VASCO JET 1000 WORKPIECE

B&S Thriftmill® wins tooling torture test at North American Aviation!



8 CHANNEL RECORDER, DYNAMOMETER AND MILL.

Thriftmill cuts Vasco Jet 1000 Steel . . . 142 inches at 130 Surface feet/minute.

It is interesting to note that the best tool life of 142" at 130 SFM produced complete break down destruction of cutter, but in later tests, on the same hardness of material, 2016" of tool life with only a .010" wear land was acquired at a more normal speed of 43 SFM.

This (Thriftmill) cutter is unique from others in this series of tests for the reasons that it is cheaper to purchase than standard cutters and its geometry is quite different.

Of course, this is what B&S has been saying all along— THRIFTMILLS ARE DIFFERENT!

For that EXTRA Edge in Production!

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Cutting Tool Division
Brown & Sharpe Mfg. Co.
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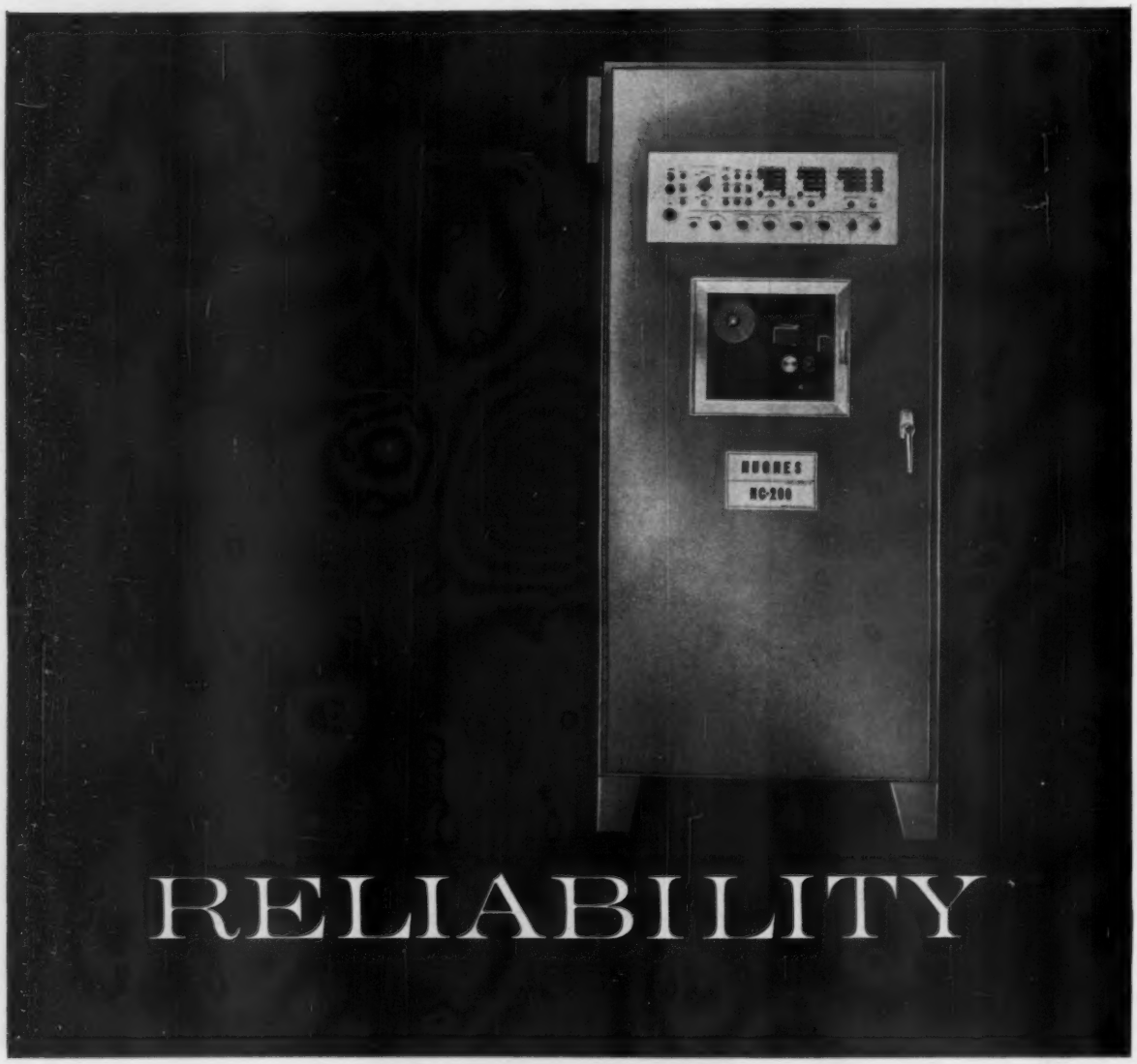


SPOT NEWS...

- **About 2000 people will be hired by Chrysler for work on the Saturn booster** program at the Michoud (La) plant of NASA. The prime contract, which runs to about $200 million, is for construction of 20 S-1 booster stages. The booster will be used to send the Apollo three-man space vehicle, the contract for which was just awarded to North American Aviation (total: about $400 million), into orbit around the earth.

- **Soviets appear to have developed a process for making artificial diamonds.** According to Tass news agency, the process involves "pressures of several tens of thousands of atmospheres and a temperature of several thousand degrees." The stones are said to be so hard that they scratch the hardest natural diamond. Soviets are using them in cutting tools.

- **An apprenticeship and training program has been set up by joint action** of more than 40 Dallas metalworking firms. A recent study showed about 800 additional skilled metalworkers will be needed there in the next five years. The 4-year program has been endorsed by the Bureau of Apprenticeship and Training of the Dept of Labor. Other training will be available for employees. Each apprentice will have to sign an agreement to stay with the company until the apprenticeship program is completed.

- **Tabata (Japan) flame-hardening plant, reportedly the largest in the world,** is now in full operation. It is the first of five flame-hardening plants to be designed (and supervised) for Japanese industry by the Detroit Flame Hardening Co. It will specialize in items for the steel industry, but is equipped for hardening machine tool and automotive industry parts as well.

- **The American Metal Stamping Association feels that by changing its name** from Pressed Metal Institute it leaves little doubt as to what the association is and who its members are. The timing of the change was good, in that the association will launch an extensive membership campaign early in 1962 and will publish a complete stamping guide at that time.

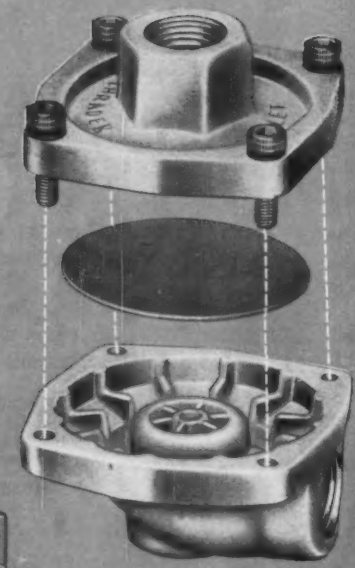
- **Metalworking firms interested in business opportunities in Australia** will be interested in a new catalog that lists 25 Australian firms actively seeking US business partners on either a joint-venture or licensing basis. Write to New South Wales Govt Office, Suite 1308, 680 Fifth Ave, New York 19, NY.

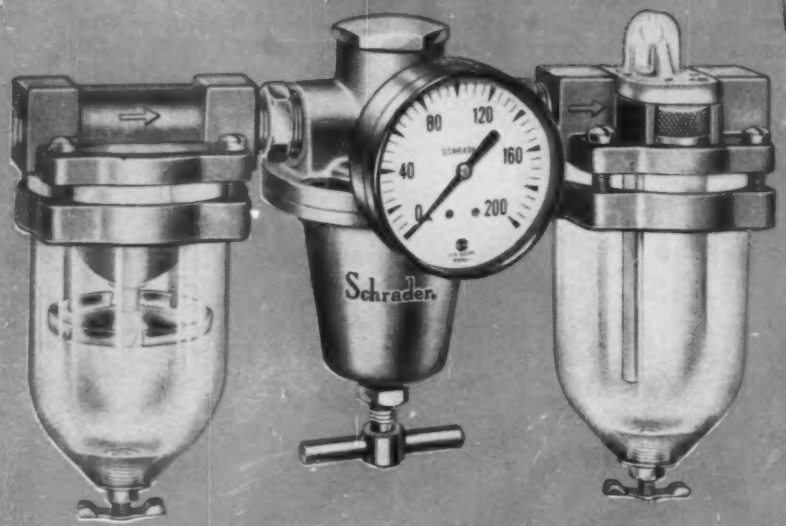
- **Pratt & Whitney Co has received orders for more than 50 Tape-O-Matic** numerically controlled drilling machines (*AM/MM*—Oct 30 '61, p139). First deliveries of the $8595 machine are scheduled for January. Company is adding special distributors to sell it, and is planning a "road show" to promote it.

- **There's been a big gain in overseas activities by US machine tool builders** and cutting tool and abrasive manufacturers. 69 builders and 11 tool and abrasive manufacturers now have arrangements involving production of their products outside the US. In all there are some 195 separate arrangements. For a detailed list write to Editor, AMERICAN MACHINIST/METALWORKING MANUFACTURING, 330 West 42nd St, New York 36, NY.

- **Navan Products Inc (El Segundo, Cal) will broaden its machine tool line** in early 1962 when it markets a milling machine attachment permitting precision duplication of irregular shaped parts up to 4 in. square (priced under $500); a precision 24-in. radial drillpress of lightweight design (about $1400); and a $2000 traversing saw, the prototype of which is maintaining a cutting tolerance of 0.005 in. per 26 inches of cut in ¼-in.-thick hardened aluminum.

THERE'S A QUALITY DIFFERENCE IN AIR CONTROL COMPONENTS...

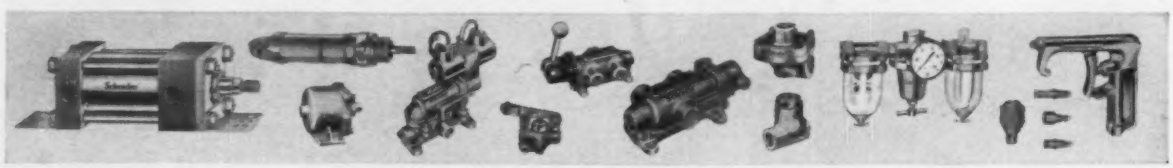




...you can see the difference in any Schrader Air Product

FOR EXAMPLE: The Schrader Lub-air-ator filters, regulates, and lubricates air to protect controls, instruments or air tools. Schrader quality is evident in its precision-made, rust-proof parts, in the accuracy and simplicity of its performance. You can use each of the three units alone, in pairs, or as shown. Size for size, the regulator has higher capacity, faster response, and less drop in pressure as loads are increased, than any other available today. Available with a new special filter and lubricator bowl of polycarbonate resin plastic—won't shatter or crack.

ANOTHER EXAMPLE: Schrader Quick Exhaust Valves can make single- or double-acting cylinder pistons operate at maximum speed. Mounted at ports, they allow any back pressure, that tends to hinder piston motion, to exhaust instantly to the atmosphere. Schrader constructs them simply, precisely, and engineers them to take pounding, vibration, and shock. The flexible diaphragm, the only moving part, is even available in teflon for applications where excessive heat is encountered. Assembles and disassembles in seconds.



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QUALITY AIR CONTROL PRODUCTS

WASHINGTON...

Defense procurement outlook . . .

As the Kennedy administration puts finishing touches on the defense budget for fiscal 1963, starting next July 1, the outlook is for a sharp increase in procurement, and research and development spending.

In terms of appropriations—practically all of which will be translated into new orders during the year—best estimates are that the procurement request will total some $2 billion more than the $16.9 billion voted this year by Congress, and that the R&D request will amount to at least $500 million more than the current $5.2 billion appropriation. In all, the total defense appropriation request is likely to amount to between $50 billion and $53 billion (at least $2 billion over this year's budget). Odds are that Congress will approve, may even vote, additional funds as it did this year.

Planes down, missiles up . . .

The aircraft budget will be heavily trimmed from this year's $5.9-billion appropriation. Air Force procurement of combat-type planes will be reduced the most. But the Air Force will step up orders for Lockheed's C-130 transport and accelerate development of the company's C-141. The Air Force will also buy a large quantity of Douglas A4D fighter-bomber aircraft, which up to now have been produced solely for the Navy.

New orders for missiles will be increased over this year's $4.2-billion rate. Greater output of Minuteman ICBMs and the Navy's Polaris will more than offset a slowdown in Atlas and Titan contracting. Spending for the Air Force's Skybolt air-launched missile will also be boosted, and funds will be set aside for the first time for Air Force development of a medium-ranged, solid-fueled missile to be deployed by NATO.

Shipbuilding contracts will probably remain close to this year's $2.9-billion level. Procurement of ordnance equipment, vehicles, and other Army combat equipment will be jacked up. Initial production of the Army's "Goer" vehicle, a fuel carrier with off-the-road and amphibious capabilities, will be authorized. LeTourneau-Westinghouse and Caterpillar have been major R&D contractors on the project and are the likeliest candidates for new production orders.

In terms of expenditures—which reflect the rate of deliveries of equipment—the procurement budget will rise considerably over this year's $16.1-billion rate of outlays. The increase will exceed the $1.4-billion rise in procurement expenditures this year over fiscal 1961, which ended last June 30. Overall, defense expenditures are expected to add up to close to $50 billion—the largest peacetime budget in US history. The current rate of annual outlays is $46.8 billion.

GAO upholds award to Baldwin . . .

A $17.8 million contract to Baldwin-Lima-Hamilton Corp to supply 15 big hydro turbines for the John Day Dam on the Columbia River has been upheld by the General Accounting Office. In rejecting Allis-Chalmer's challenge of the award, GAO also upheld a seven-year-old executive order which allows 49% of a product to be made up of foreign components and still qualify as a domestic product under the "Buy American" Act. The Act allows domestic bids a 6% price advantage over foreign bids.

GAO also upheld Baldwin-Lima-Hamilton's estimate that no more than 42% of the turbine work would be done abroad, a fact Allis-Chalmers had contested.

The Agency did agree, however, that in the future a bidder should be required to submit detailed lists of all components to be produced abroad. GAO also pointed out that since B-L-H's bid was 14% under Allis-Chalmers', there was no legal basis for upsetting the award even if B-L-H had produced more than 50% of the turbines abroad.

NLRB challenges union tactics . . .

The government is forcing a legal test of a union's right to set production limits for its members—and to penalize them for exceeding those limits. The challenge comes from the National Labor Relations Board's general counsel, Stuart Rothman, who says this tactic may violate Taft-Hartley Act rules.

According to Rothman, it's possible the device constitutes an illegal slowdown against an employer.

Rothman acted in a case involving United Auto Workers Local 283, which represents employes of Wisconsin Motor Corp in West Allis, Wis. Local officials fined six members who work on a piece rate basis at the company for exceeding the production limits set by the union. Rothman said the UAW local's action had the effect of forcing production standards that it could not gain by collective bargaining.

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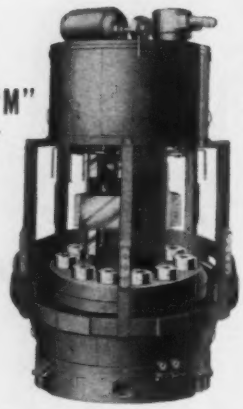

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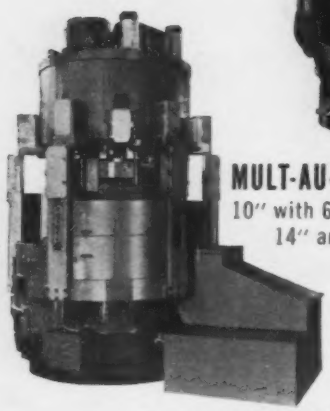
Available with 6, 8, or 12 spindles.



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10" with 6, 8, 12, or 16 spindles, 14" and 18" with 6 or 8 spindles.

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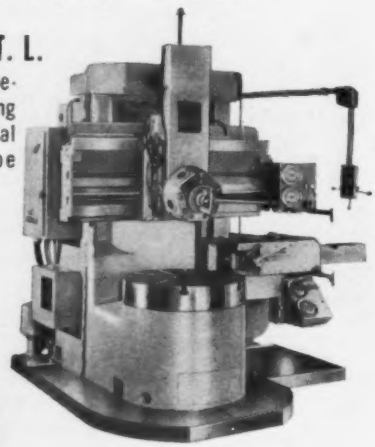
26" to 86" in 10" increments. Discrete positioning or contouring numerical control system can be applied.



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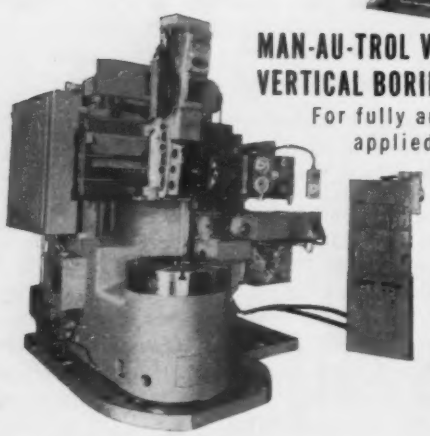
In 3", 4", and 5" spindle size. Many combinations of bed length, table size and vertical travel.



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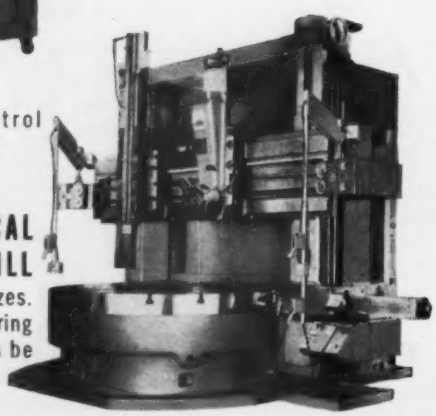


DYNATROL VERTICAL BORING & TURNING MILL
108", 124", and 144" table sizes. Discrete positioning or contouring numerical control system can be applied.

DETROIT...

Auto sales spark optimism . . .

Some of the recently dour faces around Detroit —leftovers from a grim spring and humdrum summer—are creasing into grins because of late reports of climbing auto sales, high production levels, and a great outlook for the rest of the model year. There are a few who allow that total output in calendar-year '61 will be over the levels established in '59 and '60. In any case, first signs of public reaction to the new models are good.

Production dropped a bit toward the end of November, but the reason was the Thanksgiving holiday, not any lack of new orders. In spite of the holiday, Rambler, Lancer, and Fairlane were doing well in the production departments; Chevy II was still climbing; Meteor production was trending sharply up; and the Buick Special, at around 3300 assemblies per week, was ahead of the Pontiac Tempest (at 2500 per week) and the Olds F-85 (at 1700 per week).

Truck production is high and continuing; truck builders expect to do well in '62, and might even set a new record. Their biggest year, as with passenger cars, was in 1955. Total for trucks and buses to the end of November was just over a million vehicles and, at present assembly rates, 1961's total will beat 1960's.

Aluminum keeps climbing . . .

Reynolds Metals just recently marked the one-millionth passenger-car engine made in aluminum in the US—during the week of November 26. Reynolds' pride is pardonable; it supplied about two-thirds of the aluminum that's gone into engine blocks. Aluminum engines were just over 10% of the total produced in 1961.

The light metal is going into many more applications in the '62 models than ever before; aside from engines, it's the favorite material for transmission housings. The current Plymouth uses some 70 lb of aluminum in steering-gear housings, alternator housings, and pistons for cylinders, brake cylinders, clutch, and automatic transmission. Two parts are now made of the other light metal—magnesium. These are the rotor and stator of the new Chrysler heater blower.

Bonding makes inroads . . .

Plastic-resin bonding agents, aside from the well-known application where they hold brake linings to brake shoes, are still largely experimental, though they show some promise for the future. One fairly recent application for plastic resins is in binding stamped X-members to the undersides of front hoods and rear decks, after assembly by crimping the edges of the panels. The plastic is applied at Chrysler's Twinsburg, Ohio, stamping plant, on the press line, and has some strength at that point. Final cure, however, occurs in the heat of the paint booth—at no extra cost.

Some minor decorative parts have been bonded —such as an aluminum insert bonded to a chrome molding strip in regular Chevrolet production. Ford has reportedly built up a car body completely with bonding only—no welds. GM Truck & Coach is rumored to have done the same with a truck body, but these are both experimental jobs and it will undoubtedly be several years before there are many applications where plastic bonding actually replaces welding on the production line.

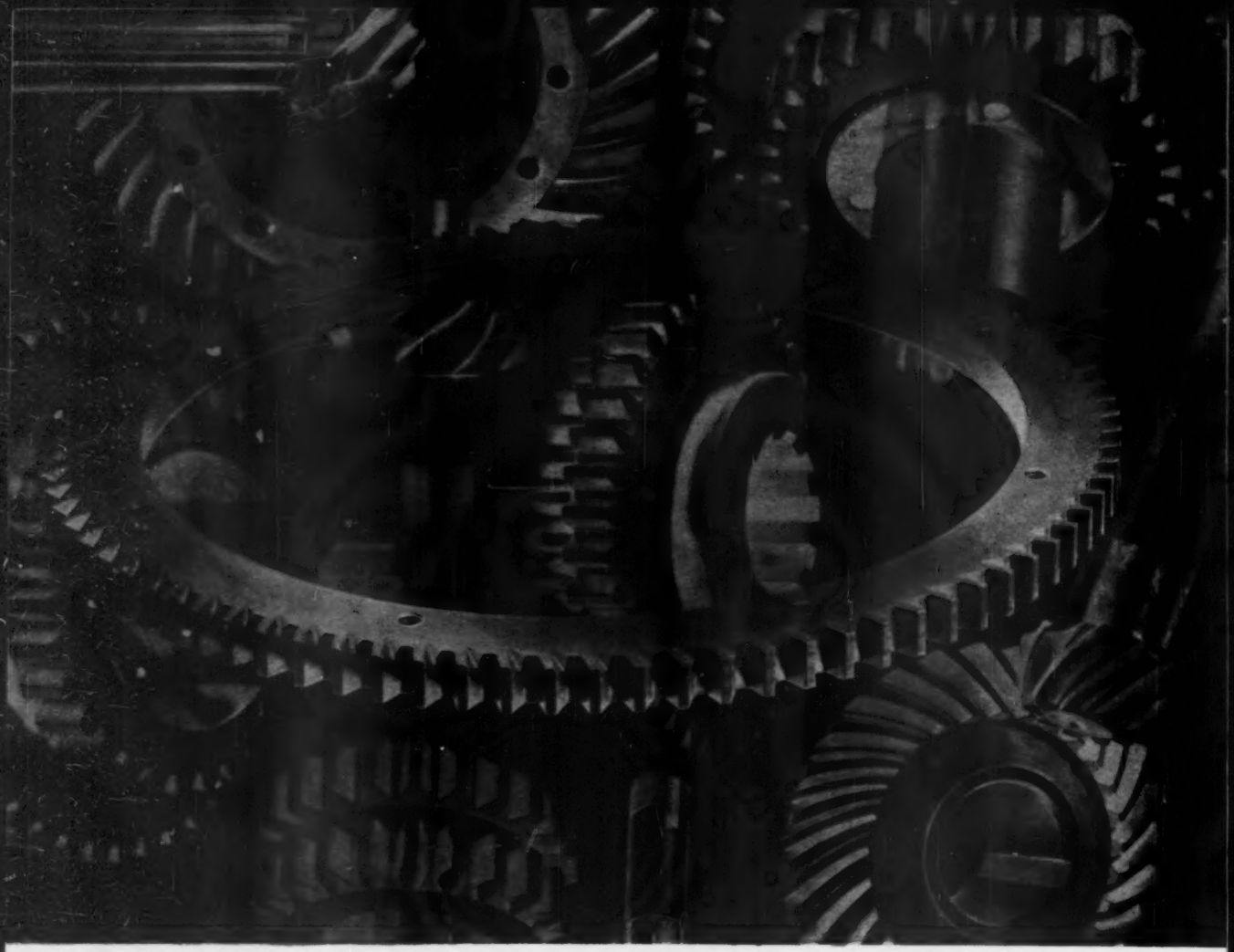
Bits and pieces . . .

Plymouth garnered two recent styling awards; one from the Society of Illustrators was for the Valiant Signet (bucket-seat hardtop) design; the other, from the National Society of Interior Designers, was for Plymouth interiors. Among factors mentioned by NSID were longer-wearing materials, better carpet fit, tougher plastic trim, and more easily cleaned linings. Happily, the whole industry is headed in the same general direction, and sleazy interiors (even on stripped models) are a thing of the past.

Automobile Manufacturers Assn reports that 43% of the "distress" road calls recently reported were involved with electrical troubles. These break down to 24% battery, 14% ignition, and 5% lamps. One answer, says Dodge, involves printed-circuit wiring, quick-disconnect terminals through the firewall, and central fuse location—which is also an industry trend.

Cardboard is still a good material in cars, and the amount applied is amazing—in heater ducts, glove compartments, trunk linings, door panels, and rear inside decks.

Rumor: Corvair, now selling around 50% in Monza models, may drop all other models and even add more luxury to classify it more completely as a sports car. This would leave the Chevy II, which is in the same price range (within $20), as the basic low-priced transportation unit.



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AIRCRAFT and MISSILES...

TRENDS

High-temperature honeycomb . . .

Temperature range for honeycomb used in supersonic aircraft, missiles, rockets, and reentry vehicles can be nearly doubled by using A 286 and Rene 41 alloys, according to tests at Rohr Aircraft, Chula Vista, California.

The materials presently used in honeycomb —PH 15-7 Mo and 17-7 PH—are capable of withstanding temperatures to 900 F.

But A 286 will go to 1400 F, Rene 41 to 1800 F. Several A 286 and Rene 41 honeycomb test panels have been manufactured using brazing alloys compatible with the heat-treating process and the metallurgical properties of the materials.

The brazing alloys are the critical part of the process. They must be able to braze the 0.001 to 0.002-in.-thick core material to the 0.006 to 0.080-in.-thick skin panels. Test programs with the high-temperature materials have exceeded expectations.

Other research programs at Rohr include the brazing of titanium alloys Ti-6Al-4V and Ti-13V-11Cr-3Al. This may result in honeycomb panels with strengths of up to 200,000 psi (at room temperature) but weighing only 60% of present stainless panels.

Cutting inventory surpluses . . .

Defense inventories now include about $13 billion in surplus equipment, just about half of it spare aircraft parts, reported Secretary of Defense McNamara in announcing the awarding of a $600,000 contract to the Logistics Management Institute, a non-profit corporation recently formed by the Defense Department.

LMI will study this problem, then make recommendations on methods of adjusting these inventories.

It will also study several other problems relating to defense procurement:

- **Simplification of designs, standards,** and specifications. About half of the 23,000 specs and standards that relate to current contracts are obsolete, according to McNamara.
- **Ways of introducing more competition** into procurement processes. About 60% of defense contracts are now awarded to single source producers.
- **Ways of increasing incentives** for high performance. Cost-reimbursement-type contracts amounted to 42.1% of the total dollar value of Defense Department contracts in fiscal 1961, compared with 17.9% in fiscal 1952.

APT management changes hands . . .

Armour Research Foundation of Illinois Institute of Technology has been appointed director of the Automatic Programmed Tool program (APT) by Aerospace Industries Association. This was announced by Dr Haldon A Leedy, director of Armour Research Foundation.

This means the Armour Research, not AIA, will have full responsibility for promoting the APT program—including lining up sponsors and training personnel in using the APT system. AIA is scheduled to step down December 15.

Patent policy hearings . . .

House space subcommittee hearings an NASA's patent policy have been postponed until sometime next year. It has been reported that the President favors a sweeping new patent policy that will be proposed as law in January.

It is the so-called "equity" plan. If the government provides all the R&D funds for a project, it should enjoy all the royalties on all inventions patented; if the financing is on a 50-50 basis, royalties should be similarly split.

Defense Department, meanwhile, has circulated to aerospace companies a number of proposed patent revisions that would, reportedly, make further inroads into industry's current rights.

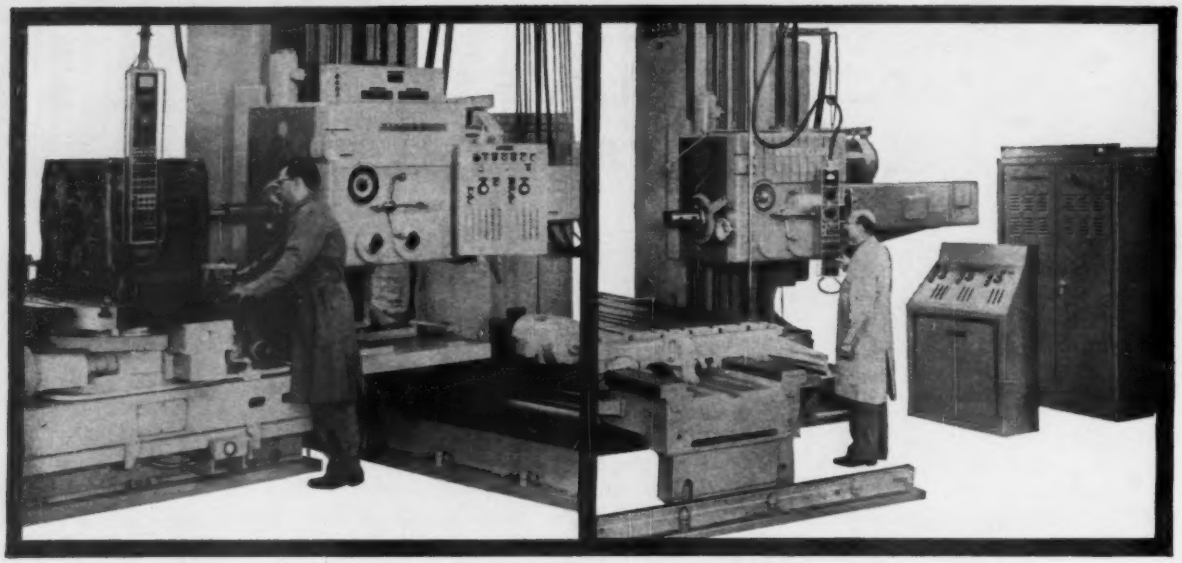
Mach 3 airliner on the way . . .

A nine-year, multi-million dollar cooperative effort by government and industry to develop a Mach 3 commercial airliner is getting underway.

The Air Force, acting as contract agent for the Federal Aviation Agency, has already received industry proposals for $11 million worth of research projects.

One or two years of R&D work is expected to lead to production of a working design by the end of 1963 or 1964. Completion of the design phase would lead to a prototype by 1966 and an operational model by 1970.

The US is going ahead despite a recently announced British-French effort to build a Mach 2.2 plane and have it in operation by 1968.



Gilbert horizontals make the most of tape

Increased output per man and machine, improved and uniform accuracy, reduced tool and fixture storage, reduced parts inventory, shortened lead time, fewer inspections—all make a tape-controlled horizontal pay for itself fast, *if the horizontal is built to work with tape.*

To get increased output, your horizontal must be basically designed (as a Cincinnati Gilbert is) to take increased operation. To get improved, uniform accuracy, your horizontal must be built (as a Cincinnati Gilbert is) to eliminate uneven wear of ways, guides, and screws.

Tape can be "tacked onto" any horizontal boring mill; but it will pay off best when it is teamed with a Cincinnati Gilbert, designed to make the most of tape.

New 4″ and 5″ series are built for tape

Both the new 4″ and 5″ series, table and floor type, are designed—from foundation up—to match the potential of tape. Exclusive LIFE-LIGN construction of ways and guides eliminates cocking of all moving units. No matter how hard you run a Gilbert under tape, you can be sure that every unit moves straight and smooth as the tape commands.

Spindle diameters are 3½″, 4″, or 5″. Vertical and horizontal travel of units can be varied. Multiple work stations increase production.

You can get any degree of numerical control you need, from simple dial-in operation to three-axis control of the machine and automatic table indexing.

Write for new literature. The Cincinnati Gilbert Machine Tool Co., 3366 Beekman Street, Cincinnati 23, Ohio.

Cincinnati

GILBERT

MACHINE TOOLS...

TRENDS

Chevrolet has new engine . . .

Chevrolet is reported to have in the works a tooling program for redesign of its standard big-car, six-cylinder engine at Flint. The new engine may have a lightweight, thin-wall, cast-iron block, like the Chevrolet II engine.

There is talk about Ford tooling activity, but it is little more than that. For the fact is that, as yet, no tooling programs worth their salt for 1963 models have come into the open.

Builders are not sure whether this means that the picking is going to be lean or auto makers are willing to wait until the last minute to place their requirements. Machine tool people recall that both Buick and Pontiac put through rush tooling programs earlier this year that were completed in a short time on a crash basis. They are hoping that there will be no repetition. Neither the Buick nor the Pontiac programs could have been completed as fast as they were except that much of the work was rebuilding.

Special machines bought here . . .

The Holden program for Australia has all been allotted. Most of the general-purpose machines were bought in Britain and most of the special-purpose units in this country, at a total outlay of around $20 million.

The current Vauxhall program (General Motors British subsidiary) is well along. The purchase of U S transfer and other special machines has been completed. In the next few weeks it is believed that the final batch of general-purpose European machines will be ordered. Total program is said to run to about $15 million, with deliveries scheduled in the summer and fall of 1962.

Replacement is main market . . .

Machine tool orders in 1962 will come from expansion of facilities for new products, from tooling for new defense weapons, and for production of missiles and other exotic defense materials, Swan E Bergstrom, president Cincinnati Milling Machine Co, said recently. But the principal new business potential is the replacement market. Improvement in machine tool orders, he believes, will depend largely on the adequacy of depreciation tax reform.

The Mill's backlog is almost $62 million, which is considerably higher than it has been. Current shipments are at an annual level of $125 million.

In 1962 The Mill's capital expenditures will be between $3.5 and $4.5 million, of which $1 to $2 million will be spent for new cost-reducing machine tools in its U S and overseas plants, according to Lawrence H Cousineau, vice president and treasurer. During the past four years The Mill has made capital expenditures of $17 million.

Operates 11 laboratories . . .

Frederick V Geier, chairman of The Mill, has revealed that the company operates 11 research laboratories with a combined staff of 205 physicists, engineers, mathematicians, metallurgists, chemists, ceramists, scientists and technicians. Carrying the knowledge from the laboratories into new products are 10 general or divisional engineering departments. One out of every 11 on The Mill's payroll, or 852 employees, are engaged in research, development and engineering. Not included are shop workers making prototypes, and experimental devices and parts.

New "machine tool" definition . . .

The definition of what constitutes a "machine tool" is about to be changed by official action of the National Machine Tool Builders' Assn.

The new definition, which is likely to be adopted at a meeting of NMTBA directors on December 14, will be broad enough to include the newer processes such as spark erosion, chemical milling, ultrasonics and presumably explosive forming.

It also will cover assembly machines that embody fabricating as well as assembly operations. One machine tool builder remarked recently that if the long-standing definition of machine tool is to be retained, at least 90% of his current business could not be so classified (most of it consists of producing assembly machines).

The redefinition of machine tools will necessitate a change in NMTBA's constitution and bylaws. At NMTBA's annual meeting at Miami Beach, the directors considered the types of machines that should be included in the revised definition.

One far-reaching effect of the change will be an enlargement of types of equipment classified as machine tools in future tariff negotiations.

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MATERIALS...

Broader steel horizons . . .

"If you can't beat foreign steel producers, join 'em," was the advice given US producers attending the American Iron and Steel Institute's annual meeting last spring. Several steel producers seem to be taking the advice. Take Jessop Steel Company in Washington, Pennsylvania. This specialty steel maker says it is developing a "tentative program" for a joint venture to construct an alloy-steel plant in India.

Partner in this venture would be Vummidiars Private, Ltd of Madras, India. Total outlay: $5 million. In addition to equity participation, Jessop would supply engineering and technical know-how for plant operation. Its potential Indian partner makes and distributes stainless-steel equipment. With an annual capacity of 7000 to 10,000 tons of finished alloy, initial production would consist of ingots, forgings, flats, and bars.

Indian government estimates show a need for 300,000 tons of tool and alloy steels annually. To satisfy this requirement, a few private firms have been licensed to build specialty steel plants, Jessop said. The Madras state government also is willing to contribute equity capital. Only a small part, of the total need can be met by the Indian government's new Durgapur alloy steel facility. US dollars, which might be used to buy alloy steel in the US, are more urgently needed for food and other critical commodities. The only practical source of this much-needed steel is for India to develop its own facilities. If the know-how of US producers such as Jessop is not offered, it will come from the USSR or the Common Market countries.

Opportunity in Europe . . .

Allegheny Ludlum International SA, of Geneva, Switzerland is a new subsidiary of the Pittsburgh company. This subsidiary is half owner of a new steel company named "Allegheny-Longdoz" which is building a stainless steel plant at Genk in Belgium, near Liege. The versatile new mill can be operated as a two-high or four-high rolling mill or as a cluster-type mill, like the Sendzimer, to roll very thin material.

Starting in about December 1962, this mill will convert material shipped from US plants. Common Market demand for stainless is expected to be substantial. Today, per capita use of stainless in the US is about three times that of Europe. The accelerating standard of living in Europe and increased industrial activity in the Common Market are two reasons for a larger stainless market.

Participation of US producers in foreign steel production can have far-reaching significance. One of the advantages which warrant paying a higher price for US products is the superior quality of our specialty steels. Similarly, the cost of materials in foreign products is a substantially larger portion of the total cost (materials plus labor) than it is in US-made products. Higher material costs somewhat offset lower labor costs.

What will be the long-term effect of applying US know-how to improving the quality and reducing the cost of foreign-produced steel? In the underdeveloped countries we sell know-how, and we gain respect, in markets that cannot afford to buy our steel. The more competitive countries provide a more complex problem.

Availability of US-quality steel overseas also may encourage more US equipment builders to set up foreign operations or arrangements. Machine-tool builders, for example, who might hesitate to use foreign specialty steels in equipment produced at overseas plants could be assured of suitable quality levels.

Rush to strip mills . . .

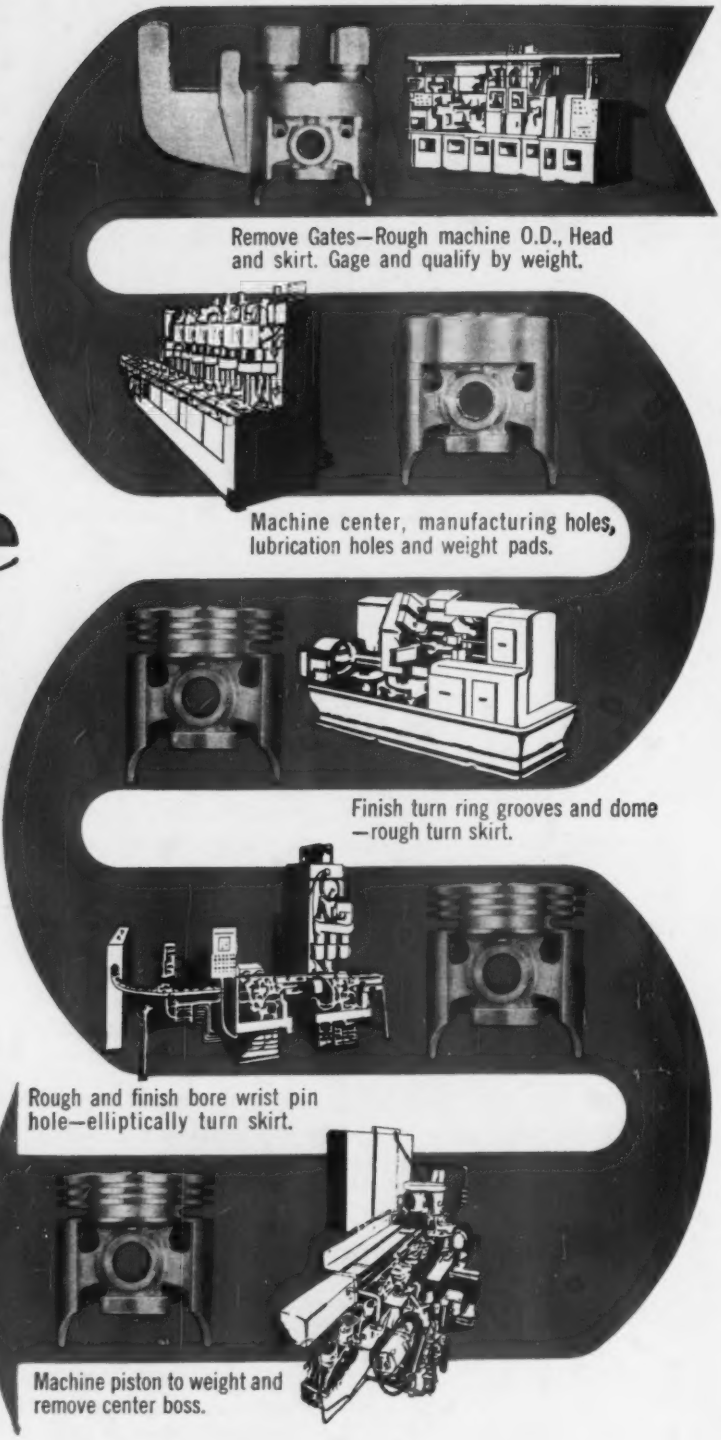
Metalworking plants in the Cleveland area will by 1963, have the "fastest hot strip mill in the world" as a neighbor, according to Avery C Adams, chairman of the Pittsburgh-based Jones & Laughlin Steel Corp. Construction of this $60 million project at the company's Cleveland Works will start early in 1962. Six finishing stands of the 80-inch hot-strip mill will turn out coils of sheet steel at speeds up to 3750 feet per minute. Output will go largely to the auto and appliance industries.

At River Rouge, Michigan, Great Lakes Steel Corp ran the first slab of steel through its new hot-strip mill on September 1. Dubbed "The Mill of the Future," it is said to be the first rolling mill which incorporates an electronic computer as an integral part. Called by Great Lakes Steel "the nation's fastest most powerful hot-strip rolling mill," it is part of National Steel Corp's $300 million modernization program. It, too, will serve the auto and appliance industry, as well as supply strip for pre-engineered buildings.

PISTONS FLOW FROM La Salle MACHINES

from rough to finished piston

600 PER HOUR



Remove Gates—Rough machine O.D., Head and skirt. Gage and qualify by weight.

Machine center, manufacturing holes, lubrication holes and weight pads.

Finish turn ring grooves and dome —rough turn skirt.

Rough and finish bore wrist pin hole—elliptically turn skirt.

Machine piston to weight and remove center boss.

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WHAT'S AHEAD... in Metalworking

TRENDS

Production equals peacetime peak levels . . .

The long awaited and frequently predicted fourth quarter 1961 metalworking upturn is here. And it looks as though it is here to stay for several months to come.

At the moment, metalworking production is paralleling the all-peacetime high level set in July, 1959 (108 on the AM/MM Index). Unfortunately, production started a downward slide in August of that year that lasted for many months.

But all signs point to a real difference this time. For one thing, the business upturn has been a slow, steady one that embraces practically every segment of metalworking.

For another, we are many months farther away from a recession that was much more drastic than it was credited with being at the time.

Automobiles and appliances, the two top consumer industries, are leading the upsurge, and an increase in defense orders is helping it along.

One especially good sign: Steel mill backlogs are building up fast, even though there is as yet little evidence of inventory accumulation on the part of customers.

November and December have been good months for the steel industry, and January gives promise of being even better.

Demand is expected to increase for flat rolled, galvanized and small diameter bars. And while these are not yet in short supply, they could be in first half 1962.

Auto parts producers expect that 1961 will wind up about 10% ahead of 1960 because of a late-in-the-year upturn.

Fastener manufacturers say that orders have shown a steady rise since the beginning of the year. As a result volume may be 10% ahead of 1960's.

Makers of screw machine products, after a not-so-good first nine months, now expect that the fourth quarter will pull up the year's average.

Tool and die shops, especially those dependent upon the automotive industry, report a "significant improvement" in orders. As a result, shops are increasing their workforces by about 25%. Current employment levels are around 67% of full-time workforce, compared with about 47% in midsummer.

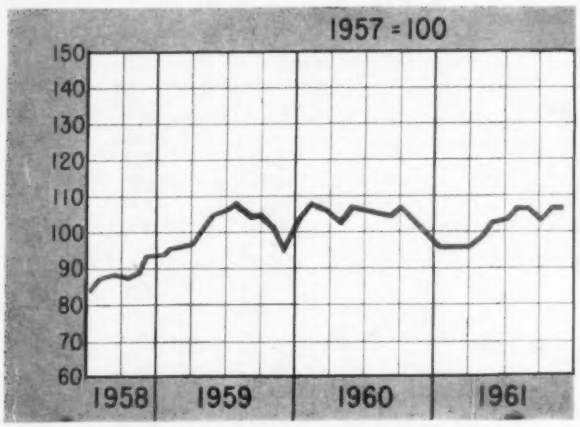
Gear manufacturers anticipate a "fair" year when the 1961 totals are in. But even so, they're hesitant to make any rosy predictions about business in the coming year.

Cutting tool manufacturers, already experiencing some increase in sales, anticipate more of an upturn in the coming months. It takes time, they say, for an upturn in consumer goods production to sift down to something as basic as cutting tools. Outlook: a 10% rise in orders next year.

Reports from railroad car makers are mixed, to say the least. One major manufacturer claims that the railroads would like to buy cars but until carloadings pick up, they just can't do it.

Another, with a new $5-million order under its belt, claims that freight carloadings *are* picking up and that the railroads are getting ready for a major buying spree.

Whoever is right, the railroad car makers certainly have no place to go but up.

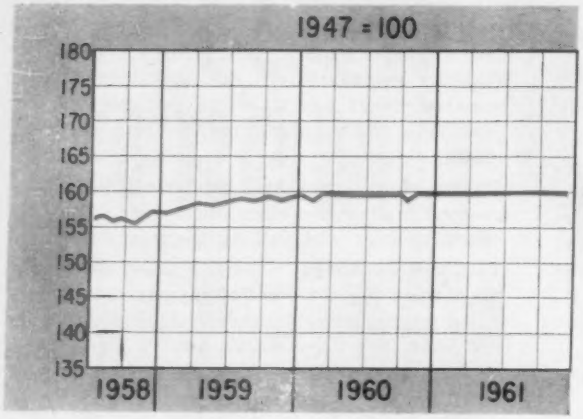


AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	NOV Estimated	OCT Preliminary	SEPT Revised	OCT Year Ago
Total Index	**108**	**108**	**104**	**104**
Machinery		**103**	**102**	**100**
Electrical Machinery		**119**	**118**	**107**
Autos		**111**	**95**	**119**
Other Transportation		**95**	**93**	**90**
Other Metalworking		**113**	**109**	**109**

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

159.3 Total Index

	NOV Estimated	OCT Preliminary	SEPT Revised	OCT Year Ago
Total Index	**159.3**	**159.4**	**159.4**	**159.4**
Metalworking Machinery	195.3	194.5	193.3	
Other Machinery exc. Electrical	174.0	174.2	173.3	
Electrical Machinery	156.9	156.6	158.7	
Fabricated Metal Products	147.0	147.0	147.4	

Christmas cheer in the retail markets . . .

On the business scene the consumer is a mighty important fellow, and this is his month. Every store from Eastport, Maine to Coos Bay, Oregon will be wooing the consumer in the pre-Christmas rush.

From all the evidence at hand, sales will be rewarding. Merchants across the country report big crowds, and most important, they are buying. A hint of the consumer's mood was given as early as October when total retail sales, after adjustment for normal seasonal increases, rose 2.5%.

In dollar terms, $18.6 billion in sales were pushed over retail counters in October compared with $18.1 billion the previous month. By comparison with the same month of 1960, the retail trade figures do not tell as cheery a story.

These figures, which, incidentally, include restaurants and service stations, do not tell the whole story about consumers. To get the broader picture, we must turn to the consumer expenditures figures in the gross national product compilations. In these terms, consumer spending in the fourth quarter of this year will run $25 billion higher than in the same quarter of 1960. Despite the fact that merchandise sales compared with a year ago — both durables and soft goods—are not particularly frisky, spending on consumer services is up sharply. And don't think services aren't important.

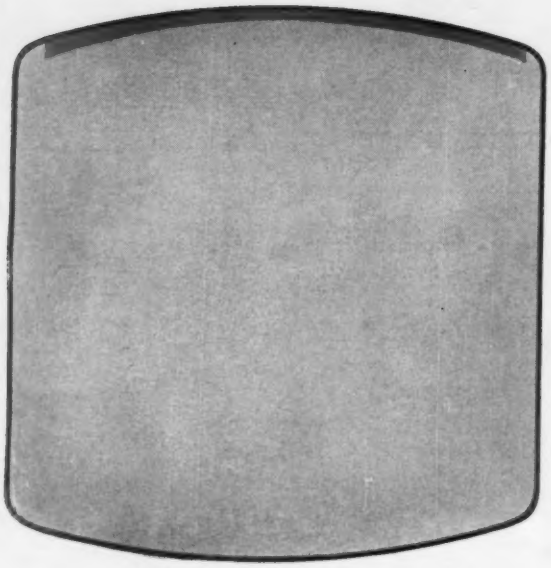
Spending for merchandise often takes a long time to filter back into the spending stream again, but spending for services is often the wage payment to an individual who has an immediate stimulus to go out and buy something.

For metalworking men, the split between consumer durables and the rest of the spending is particularly significant. If sales of the big-ticket items hold up as well during the pre-Christmas rush as they were late in November, total consumer durable sales should hit an annual rate of $45.0 billion for the fourth quarter, up sharply from $42.0 billion in the previous quarter.

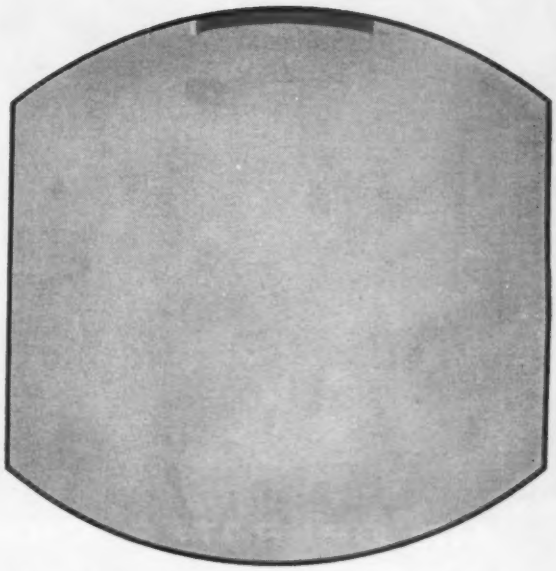
WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	162.0	162.3	144.4
Steel ingot production (thousand tons)	2,032	2,037	1,367
Electric power output (million Kilowatt hours)	15,330	15,678	13,884
Production of automobiles	124,678	154,230	111,091
Engineering construction awards (*Eng. News-Record*, thousands)	$70,167	$70,473	$81,206

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	317	304	285
Vacuum cleaners sales (thousands of units)	302	270	302
Washer sales (thousands of units)	323	265	279
Household electric ranges sales (thousands of units)	82	71	80
Radio production (thousands of units)	1,452	937	1,102
Television production (thousands of units)	698	510	621
Gear sales index (1947-49=100)	223.3	252.5	197.9
Foundry equipment new orders index (shipments, 1947-49=100)	—	62.0	92.4

* Seasonally adjusted



NEW: Now, SKF's improved "C" type design extends contact area over the entire length of a longer roller element.



OLD: In older flanged type bearings, effective contact area was no longer than the red line.

CAPACITY:

SKF®'s new "C" type bearing increases capacity as much as 54% by giving the roller some growing space.

The space was always there, but, until the SKF "C" type bearing, it was occupied by undercuts and fixed flanges. SKF removed them so the roller could be lengthened over a wider raceway.

Result: *The SKF "C" type bearing increases capacity up to 54%—corresponding to more than 4 times longer service life.*

SKF PUT THE GREATER LENGTH TO WORK. Length alone is not enough. It's only the raw potential for greater load-carrying capacity. A high capacity bearing has to be designed to *realize* that potential. Here's how the "C" type does it:

- CLOSE OSCULATION, that is close conformity between rings and rollers, distributes load evenly over the *entire* length of the roller.
- AN AXIALLY FLOATING FLANGE, combined with the symmetrical roller, assures automatic and *even* distribution of load under any combination of radial and thrust loads.

See for yourself! Ask your SKF man to show you his desk top demonstration of the new "C" type bearing. 6127

SKF MOTION ENGINEERING

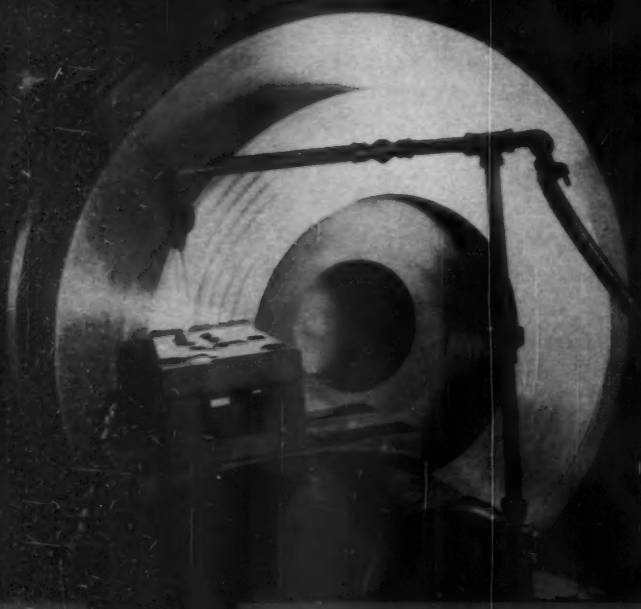
Advanced ball and roller bearing technology

*use Airpower–not Manpower**

CUSHMAN

AIR OPERATED CHUCKS AND CYLINDERS

* Cushman Air Operated Chucks speed production and improve product quality, eliminate fatiguing hand wrenching, plus related rejects and accidents.



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Cushman also manufactures manually operated chucks, power wrenches, and face plate jaws.

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American Machinist / Metalworking Manufacturing ESTABLISHED 1887

Don't Become a Casualty

When is a machine tool not a machine tool? The answer is when it is a spark erosion machine, a chemical milling machine, an ultrasonic machine or an explosive forming machine.

All of this confusion is about to be changed by formal action. No longer will a machine tool, by official definition, be a machine that merely cuts or shapes metal.

This action is logical . . .
and inevitable. For the fact is that in the past few years a whole series of revolutionary new machines has come into being that will help solve problems that appeared to be insoluble.

That is not all. The world of conventional machine tools is not what it used to be. Look at the growth of and interest in numerical control and what it is doing to change manufacturing concepts. In appearance, let alone in other aspects, many machine tools today bear not the slightest resemblance to the familiar machine tools of yesterday.

This revolution goes way beyond machine tools into materials and component parts. New steels and alloys are being developed to meet the needs of our nuclear age. And even though many of them have been inspired by urgent national defense requirements, they are being applied ingeniously and profitably to civilian products.

Makers of motors and bearings . . .
to cite only two examples, are doing things that they never did before. Take miniature bearings. Here is a case in which defense necessities have led to development of a new product and a new industry. And, unless I miss my guess, plenty of applications of miniature bearings will be turned up in commercial products as time goes on.

These sweeping changes are not confined to machines, materials and parts. They include men. How often have you heard the remark that men do not want to work as hard as they used to? Yet their wage rates and fringe benefits go steadily up year after year. And the end is not in sight.

Management then is literally driven to greater mechanization of its manufacturing processes to keep costs from going out of sight. It is the only way in which to achieve more productivity per worker.

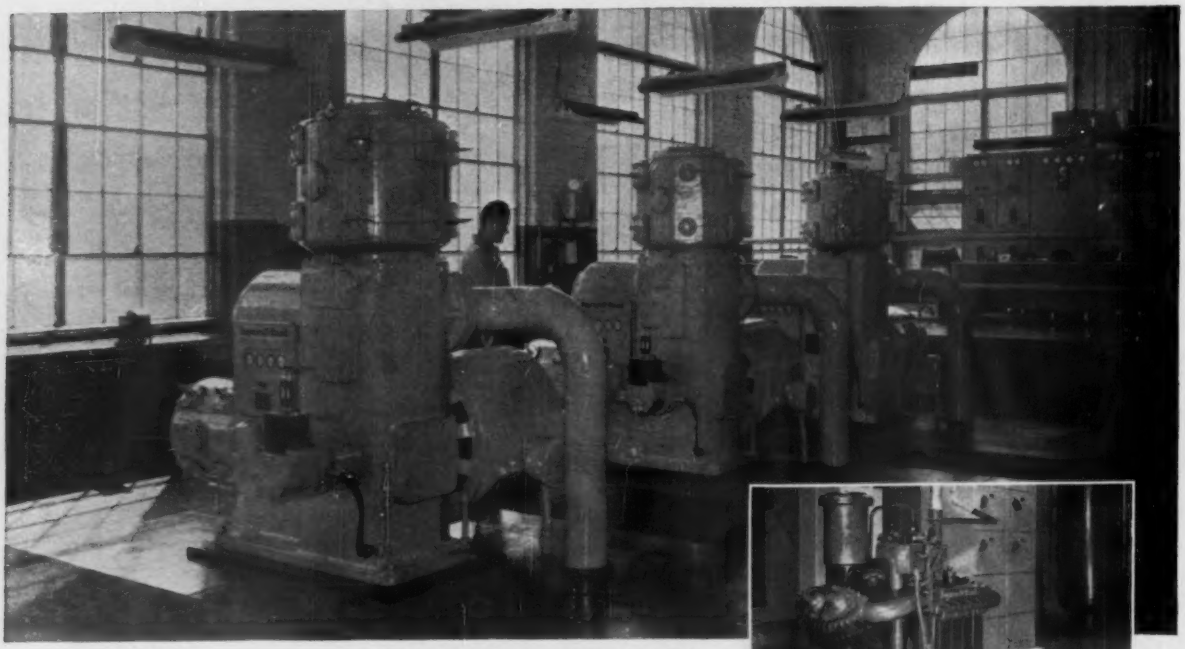
As industry becomes more automated, with men being relegated to pushing buttons and with machines getting more and more complicated, the shift to scientists, engineers and technicians is being speeded. But even pushing buttons is not as simple as it sounds, and so more skilled and fewer unskilled men are required as factories become more automatic.

These fundamental changes . . .
do not stop even here. They extend into international marketplaces. The fabulous success of the Common Market endeavor will seriously affect American participation in world trade. Think of the implications if our country should become an integral part of the Common Market, as certain influential people are suggesting.

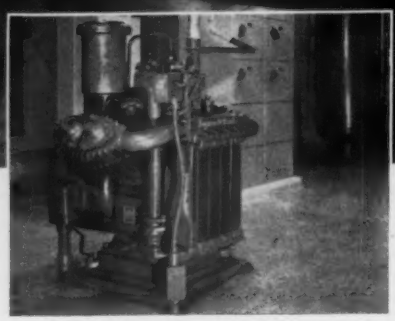
The point is that, with this mighty whirl of changes blowing like a tornado, no management will be able from here on to sit long on its assets and not shift its position. If it insists upon being complacent and on "staying put," it is almost sure to become a casualty.

Burnham Finney EDITOR

How to squeeze more profits out of your COMPRESSED AIR POWER



Three 125-hp XLE compressors generating air power for a weapons plant. This compact two-stage unit features pipeless Thru-Frame air flow and full-floating aluminum bearings which never need adjustment. Sizes 125 to 350 hp. (Other I-R air compressors to 4000 hp.)



This air-cooled two-stage Type 40 compressor is one of several furnishing plant air and instrument air in a power plant. Sizes 25 to 125 hp. (Others from ½ hp.)

Make sure you have enough pressure at point of use—and extra dependability at point of generation

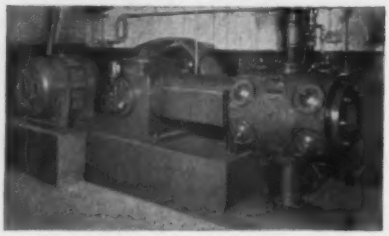
Cost-conscious plant engineers and production men know that to get the full savings inherent with air-powered equipment, you must have full air pressure at every tool.

But it's equally important to guard against unscheduled shutdowns where your air power is generated. This problem can best be solved at the time of purchase, by specifying compressors that have an extra margin of safety against mechanical troubles.

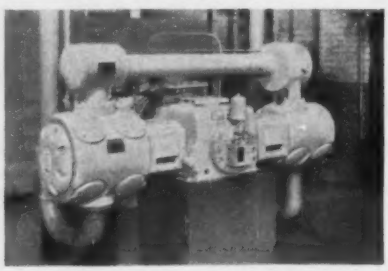
Ingersoll-Rand compressors have that extra safety margin built in. They'll stay on the job longer, with minimum attention and maintenance. Take valves, for example—the most "vulnerable" point in any compressor. Only I-R compressors have Channel Valves, known the world over for efficiency, quiet operation and long life. Their exclusive air-cushioned action eliminates impact and greatly reduces wear.

Also in I-R compressors, all running parts are sealed against dust and dirt which might cause wear. The seal need never be broken, since bearings are a type which will never need adjustment.

For top compressor performance and long-run economy, specify Ingersoll-Rand. And ask your I-R representative to show you how to get your maximum *"Dividend on Payroll Dollars"* with a Planned Annual Review of your air power system.



Ingersoll-Rand's new ESH horizontal compressor, here in a tool factory. Sizes 20 to 150 hp. Also built as vertical unit, called ESV.



Two-stage balanced-opposed PHE compressor handling air in a gas plant. Also built as L-design unit with packaged intercooler. Sizes 75 and 100 hp.

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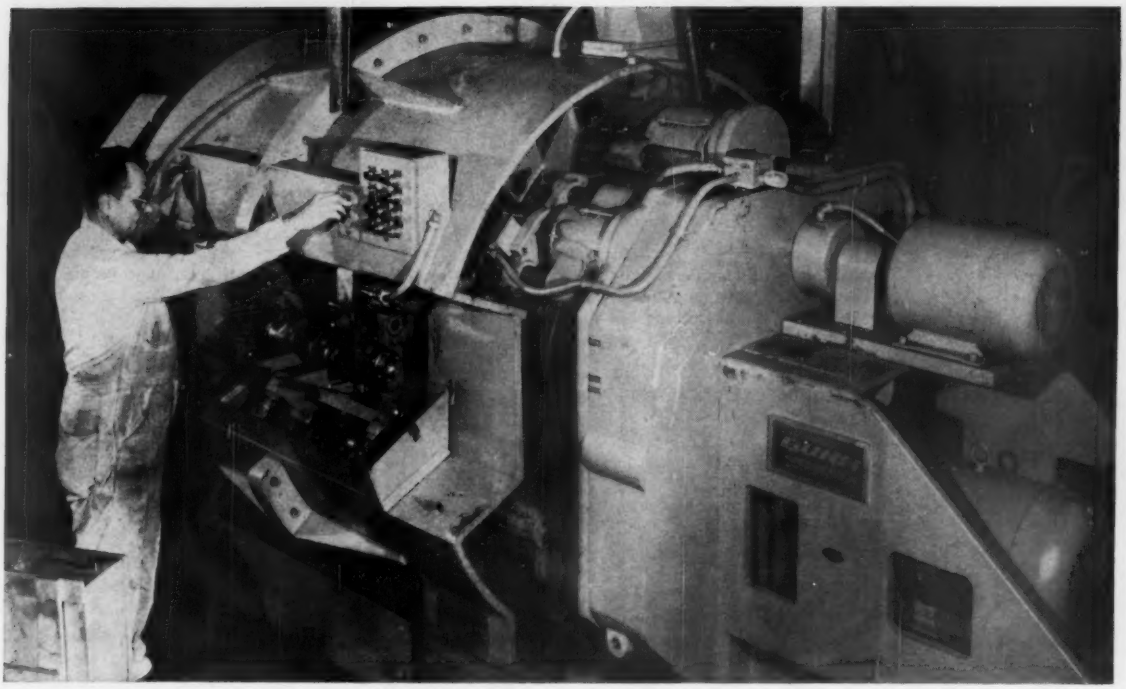


Trunnion machine drills ends of both steel and nodular iron tractor crankshafts with no change in fixturing and only a minor speed change at Ford's Highland Park plant. Work is handled in and out of the fixtures by an electric hoist

Flexible setups broaden tractor output

Tooling expands a product mix

By Charles Emerson,
Detroit Editor

When runs are fairly short, and when the end products involve many possible combinations of parts, tooling has to be flexible. Here is how Ford dovetails new tooling with existing equipment to integrate machining of its lines of light (four-cylinder) and heavy (six-cylinder) tractors

The farmer is a tough customer in anybody's book, and he is especially hard to please when it comes to choosing the tools of his trade. For the average farmer, probably the biggest single purchase he makes to aid him in his work is a tractor.

He wants just the right machine and he wants it equipped with just the right features for the job he has to do. For this reason, every tractor that comes off the line is something of a "special" tailored to the farmer's particular needs.

To the manufacturer, this means fairly short runs of any one model and a product mix that includes a great number of part combinations.

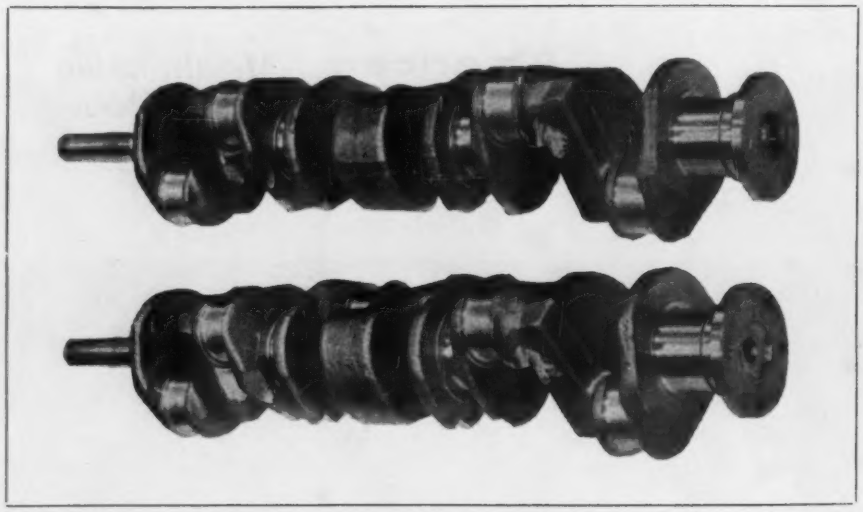
That's the reason why tooling flexibility is essential in the manufacture of tractors at Ford's Highland Park plant—the same plant that produced the farmer's other longtime friend, the Model T, for many years.

At Highland Park, the company has integrated machining operations on its standard 4-cylinder light tractor with new operations for its heavy-duty, 6-cylinder 6000 Series tractor. This has been done primarily by installing new, flexible tooling on existing machine tools.

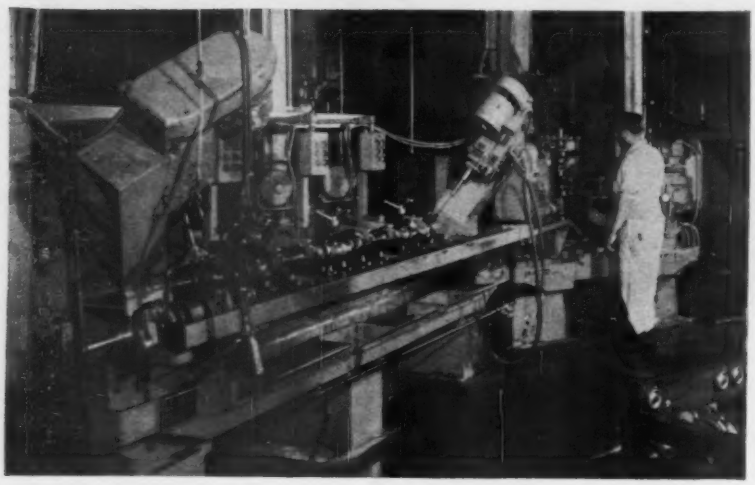
Three examples of this:

- Tooling that can cut either forged

Tooling expands a product mix



Machined and unmachined steel forged shafts for diesel engines have drilled flange on the near end. Crank and main bearing diameters have already been machined. Milled locating pads are barely visible on left side of lobes near shaft middle



Bench drill with three positions produces oil-passage holes in crankshafts. Spindle adjustment is the same for either nodular iron or steel crankshafts

steel or cast iron with no change in setup except a shift in speed.

- A line that machines three different hydraulic valve bodies with only minor setup changes.
- A machine on which spindles and mounted tools are changed so as to hold centerlines in holes spaced at odd angles on a large workpiece—so that the workpiece doesn't have to be shifted.

Flexible tooling such as this is a hallmark, as well as a necessity at Highland Park, where costs must be cut to the bone to keep pace with a highly competitive market.

This fine dovetailing of new tooling with existing equipment represents the most economical way to piggyback production of heavy tractors on already-installed lines for manufacturing light tractors.

To stay with the current trend toward heavier tractors (in industry as well as on farms), Ford centered production of its big 6000 Series machines in the same plant that continues to build the smaller ones. This was done by adapting some existing equipment to handle machining of parts for both tractors, and by installing equipment to make parts for both the gasoline and diesel versions of the larger, 6-cylinder engines.

Incidentally, the big 6000 Series tractors have 10-speed transmissions, and such options as power steering—all adding to the complexity of production.

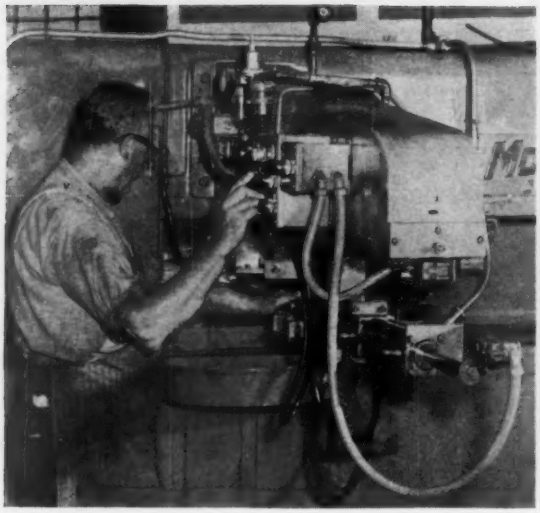
Engine tooling

Six-cylinder crankshafts, either forged SAE 4145 steel for diesels or cast nodular iron for gasoline engines, are machined at both ends in a single Buhr trunnion machine. This has seven working stations (plus an eighth for loading and unloading) that perform 32 operations, among them centerdrilling, drilling, chamfering and tapping. Most operations are done at the larger, flanged end which attaches to the tractor flywheel.

All cutting tools are HSS and are designed with angles suitable for machining both the steel and nodular iron crankshafts. Cutting speeds range from 25 to 40 sfpm on nodular iron and up to 60 sfpm on forged steel.

All that's needed to switch the trunnion machine from machining of nodular iron to machining of steel (or vice versa) is a single master-gear speed shift. This shift raises all speeds—rotary as well as cyclic—about 40% for the iron parts. And, of course, it reduces speeds 40% if the switch is from iron to steel. In either case, the relationship of rotary workpiece speed to feed stays the same.

The two crankshafts are slightly different in appearance, mainly because of extra weight lobes on the nodular-iron shaft, which improve



Spline roller produces transmission shafts and power-takeoff shafts with a standard 20/40 pitch, so that one set of tools can roll all splines to contour, regardless of diameter

Induction hardener treats axle holes in nodular iron hydraulic lift arms, producing Rh 55 C. Result: conventional hardened inserts are unnecessary

low-speed inertia in the gasoline engine. This is necessary because so many farm tasks are performed at low engine speed—and the engine is designed for maximum torque output at a much lower point than on a passenger car engine.

Fixtures fit both shafts

But major dimensions, such as length, main-bearing diameters, pin-bearing dimensions, and bearing locations are the same on both shafts. Thus, either forged-steel or nodular-iron shafts will fit the workholding fixtures on the trunnion machine.

Main bearings No. 1 and No. 4 fit against hardened V-pads, and a hardened plug in each fixture fits between the opposed thrust faces of No. 3 main bearing. This bearing takes all thrust loads when the engine is operating, so all end locations are made from the cheeks of No. 3 main bearing throughout machining operations. Each crank is located rotationally by a milled notch that fits against another hardened pad on the fixture before the clamps are tightened up.

Load and unload time, within the 21-second cycle for iron shafts or the 41-second cycle for steel shafts, is adequate for an operator to lift each crankshaft with an air hoist.

Close to the trunnion machine is a Wickes pin turner, which also takes advantage of identical dimensions on the two shafts, by turning and facing the crank-pin-bearing diameters and lengths on both shafts. A setup change is required on this machine because the crank-pin throw differs between the two shafts by 0.150 in. Therefore, a master crank on the machine must be changed between batches, thus changing the length of reciprocating action at the toolslides, which move back and forth as the crankshaft rotates on its own centerline.

The tools are also changed at this time—not because HSS toolbits will not cut both materials, but because on these small diameters (smaller than the main-bearing diameters) the clearance angles are even more critical.

Down the line from the trunnion machine is a Leland-Gifford drill setup with a single flat table base and three drilling positions fitted with adjustable drillheads at various required angles. These cut oil-passage holes in either type of 6-cylinder-engine crankshaft. The work is too heavy to move around much, but it can easily be slid along the flat table from station to station, pushed against positioning stops at each location, and clamped for drilling.

Rolling processes

One advertised feature of the tractor engine—rolled fillets next to each main and pin bearing—imposes compressive stresses at the critical sections, increasing the fatigue life from 25 to 40%.

Both the 4-cylinder and the 6-cylinder crankshafts, in forged steel, are fillet-rolled at the same machine with minor setup changes. Hardened steel rollers operate at 187 lb for 12 revolutions at each fillet, taking about 45 seconds cycle time for each crankshaft.

Another rolling process, spline rolling, has taken over much of the spline work in Ford tractors. Most of the PTO (power take-off) and transmission splines have been designed for rolling, and can be handled on two Michigan Tool rolling machines. A third spline roller does axle shafts for the light tractor.

Machine handles 15 parts

One machine handles from 9 to 15 parts with a single set of hardened rolling tools, producing splines of different diameter but with the same 20/40 pitch and stub-tooth profile. The whole 10-speed transmission was designed for rolled splines. Other spline-rolled parts include the hydraulic-lift shaft and the PTO shaft, which projects from the tractor main axle housing to power auxiliary equipment.

High-powered machining has a place, too. For example, a pair of special Kearney & Trecker 100-hp milling machines are tooled to plunge-cut three pockets in a solid steel forging that becomes the planetary housing for the rear axle. One machine does roughing, the other finishing. In case of shutdown, one machine can do either roughing or finishing to keep up limited production until the other machine is again operational.

Another pair of high-powered machines, Bullard Hydrofeed tracer lathes of 50 hp each, turn axle shafts

for both tractors, working from templets.

In the miniature category, a new induction-hardening setup treats axle holes in hydraulic-lift arms, raising the surface hardness inside the hole to Rh 55C, and making hardened inserts unnecessary. The nodular iron is hardened by manually placing the part so the hole fits over a small probe for a few seconds, exposing the hole ID to induction current. The probe is a nylon core wound with a wire coil, and covered with tape to prevent shorts or damage to the wire if the part should touch the probe.

Long machining line (this is the inspection end) produces three different hydraulic valve bodies: for power steering, power takeoff, and transmission control. Setups are more or less permanent. Parts are routed only to selected machines

Hydraulic valve bodies

A long and complex machining line does all the drilling and outside machining on three different hydraulic-valve bodies that fit into the various tractor power systems. Some of the equipment is multiple spindle, other units are adjustable-spindle types. And there are milling heads and simple spindles for counterboring, honing, and other operations.

These machines are lined up for through parts flow, but each different valve body must be routed separately to be processed by separate spindles and tools, as well as by some common heads.

In most cases, there is a specific machine spindle or group of spindles for each hole or set of holes in each valve body. Thus, each body must be routed separately down the line, skipping some stations, and taking in others. In some cases, a station may be individually retooled for a new batch of parts, but changeover work is generally held to a minimum.

Equipment brought into the plant came from all sources, some entirely new, some reconditioned, and some obtained from other Ford plants. The result is a complex machine lineup through which batches of parts can be routed quite rapidly. In case of any future design changes, the machining capability of the line is probably sufficient to allow new routing with only minor tool changing.

Replaceable spindles at a rear-hood fixture allow such operations as drilling, reaming and counterboring of bolt holes without repositioning the heavy workpiece

Removable spindles

To machine mounting holes in both the 376-lb cast-iron front hood and the 94-lb rear hood for the large tractor, a special machine holds the work in a fixed location and mounts Gardner-Denver Airfeedrills around the periphery at required angles.

Each drill spindle is fitted with a single tool, mounted permanently. When successive operations are required—such as drilling and reaming; or drilling, tapping, and counterboring—the spindles are lifted out and replaced. This means the heavy workpieces need be hoisted into the fixture only once. Pulling out and replacing the spindles is much easier and faster than moving the work.

Engine blocks

If crankshaft machining can be considered to have dual capability, then engine-block production is a triple-threat operation. The basic blocks are produced in Ford's Cleveland engine plant on much the same equipment that turns out passenger-car 6-cylinder engine blocks. Though the two tractor engine blocks are not identical, and both differ from passenger-car engine blocks, many of the same machining operations are common to all three.

In some cases a change in tooling is required, and in others separate machining heads are employed. Because the change is one of retooling rather than one involving additional capital equipment, the 6-cylinder engine blocks are produced at a minimum cost. •

Seven case histories show...

Where form grinding pays off

Under the right conditions, centerless grinding with a formed wheel (either crush-dressed or diamond-dressed) can bring big dividends in increased production. Here are seven examples of what the technique can do

By George P Burns,
vice president,
Van Norman Machine Co, Springfield, Mass

Like all machine tool builders, we get frequent requests from companies who want more efficient ways to machine components. Usually, the complaints are that the current process is not fast enough, or that tolerances are difficult to hold consistently, or that production costs have been running too high.

As often as not, our engineering staff comes up with this solution: *Centerless-grind the part with a formed wheel.*

Obviously, this technique is no panacea for every grinding problem. But in a surprising number of cases, it can be adapted to give the user the quality production he is looking for. At the same time, the production rate jumps dramatically, and tolerances are much easier to hold consistently.

Basically, there are two techniques for producing formed wheels: diamond dressing and crush dressing. Each has its own advantages, depending on the user's particular job.

Crush form grinding works best when:

- Production quantities are reasonably large.
- Materials of high tensile strength (titanium, Waspaloy, Inconel, stainless steel) resist turning but must be machined to close tolerances.
- Wheel contour can't be produced by diamond dressing because of extreme profile restrictions.
- Heavy stock removal, with fast and cool cutting action, is called for.

Diamond-dress form grinding works best when:

- Production quantities are low.
- A refined surface finish is specified.

Advantages of form grinding

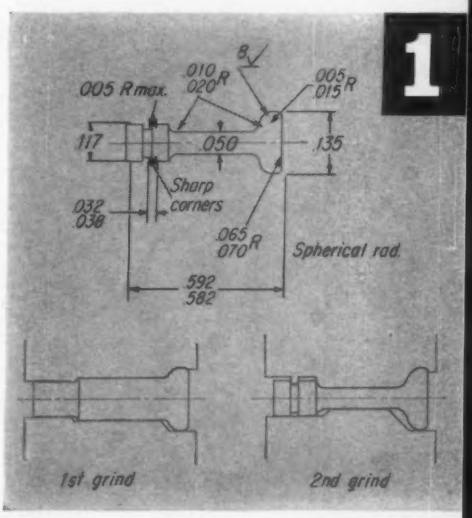
Both methods produce these advantages:

- They combine several machining operations into one.
- Blending of adjacent surfaces, when specified, is easier.
- More complex forms can be produced in a single operation.
- On parts with multiple diameters, control on concentricity is closer.

Potential not yet realized

Well established in some industries (the automotive, for instance), form grinding still has not realized its great potential. The following case histories from our engineering files—all involving centerless grinding with a shaped wheel—show what can be done when form grinding is able to replace other machining techniques. Examples of both types of form grinding are presented here.

1



PROBLEM: Produce at the lowest cost a small nozzle valve (illustrated at right) that goes into a fuel injector. On this high-speed-steel part, hardened to Rh 58-62C, a finish of better than 10 micro-in. rms was required. The old method was to rough-turn the part on a screw machine, harden, and then finish-grind to size in five different operations.

PROPOSAL: Grind with a crush-formed wheel in three operations:

(1) Rough the workpiece (a hardened blank) with regulating and grinding wheels formed to shape as illustrated.

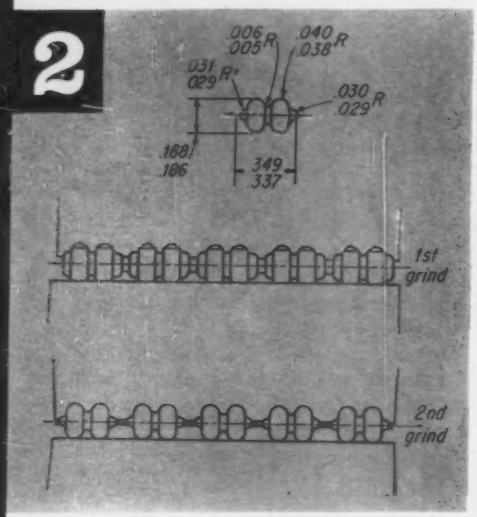
(2) Finish-grind the narrow groove (see sketch), the long diameter in the center, and the 0.010/0.020-in. radius.

(3) Finish-grind the diameter to get the sharp corners called for. Also, grind the 0.065/0.070-in. valve radius to finish size.

RESULTS: The three-step proposal was much faster than the method it replaced. Operations 1 and 3 produced 180 pieces an hour; operation 2 produced 150 pieces an hour. Overall finish of 8 rms was well under specifications. And the new method cost only one-fifth as much as the old one.

Form grinding pays off...

2

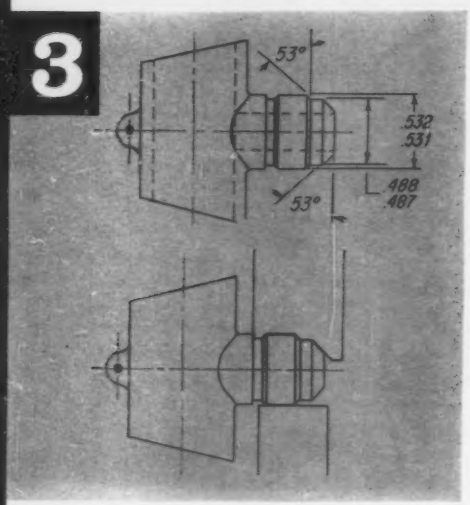


PROBLEM: This part, a small bearing known as a roton, was a new product that the customer wanted to mass-produce. Here roundness, accuracy of radius, and finish were extremely important. Material was 52100 steel hardened to Rh 60-62C.

PROPOSAL: Centerless-grind with a crush-formed wheel in two operations: a roughing and a finishing. Because the part is small, nine pieces could be ground at once from a hardened-steel blank. The two operations would remove 0.150 in. of stock. Leave 0.010 in. of stock between each piece, so that unloading is easier. After removal from the machine, each piece could be easily separated.

RESULTS: Production rates were high: 120 blanks an hour rough-ground, 180 blanks an hour finish-ground. Efficiency of both operations was 100%. The finish was in the 10-12 rms range.

3



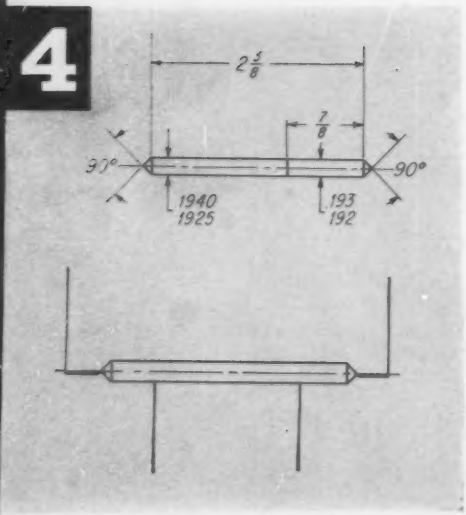
PROBLEM: On this stainless-steel forging, the two diameters and angles specified in the sketch were turned on a screw machine, but chatter and runout were major problems. The 53° angles, which had to show 90% blue when checked in a master gage, were particularly difficult to hold to tolerances. Could a grinder do the job—at a lower cost?

PROPOSAL: (1) Rough the part on a screw machine to a straight diameter of about 0.535 in., with the 53° angles slightly oversize.

(2) Finish-grind with a crush-formed wheel. To support the work, use a straight regulating wheel, plus a hold-down to keep the part from tipping.

RESULT: This approach was very successful, producing 240 parts an hour with no rejects. And the user was able to grind as many as 1500 parts per wheel dress.

4



PROBLEM: A tap manufacturer wanted to reduce the number of grinding operations on tap blanks, at the same time improving the concentricity between the blank's OD and male centers. Because the taps are held between centers for threading and fluting operations, the tap's accuracy depends on the concentricity of the OD to the centers.

The old method involved five steps: The OD was semi-finish ground; the male centers were ground in separate operations. Then the shank and back taper of body diameters were ground. But concentricity was hard to hold.

PROPOSAL: (1) Diamond-dress the entire profile of the tap in the grinding wheel. (Here diamond dressing was specified because of the fine surface requirements.)

(2) To speed production, use a special magazine-loaded fixture that will feed as many as 240 tap blanks automatically.

RESULT: One machining sequence produced 240 ground taps, with no rejects. Tolerances were well within the 0.0005 in. allowed, and concentricity between ends was held to within 0.000050 in. Because of the loading fixture, one operator could run three machines.

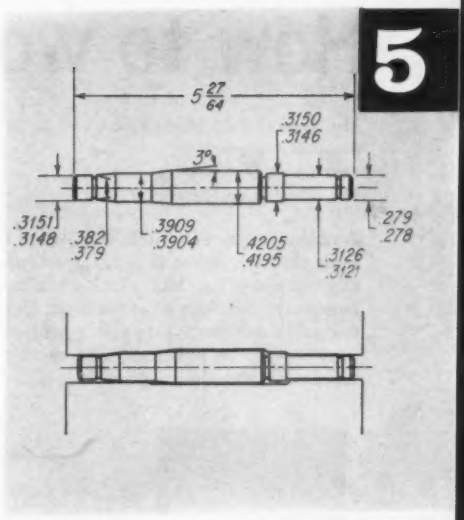
5

PROBLEM: A maker of electric motors sought ways to reduce the cost of grinding small rotor shafts, at the same time increasing production rates. The shop was grinding the shaft in several operations, at a top output of 240 pieces an hour.

PROPOSAL: (1) With a diamond-dressed wheel, grind all diameters in one operation.

(2) To boost production, equip the grinder with automatic loading and unloading devices.

RESULT: Production (480 pieces an hour) was twice the old rate. Run-out was held to less than 0.00015 in.

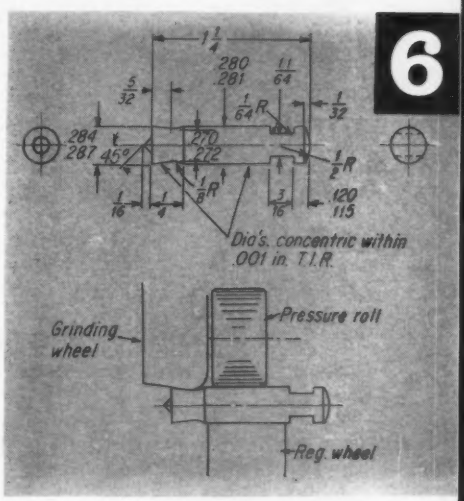


6

PROBLEM: A punch manufacturer wanted a quicker way to grind the back taper on punch ends—after the shank OD had been finish-ground. The problem here was to grind the back taper separately, yet still hold the body diameter concentric with the cutting edge of the punch. Stock removal required was 0.008 to 0.010 in. on the taper diameter, and the back taper was to blend with the turned taper radius.

PROPOSAL: Form grind with a diamond-dressed wheel. Use the regulating wheel as a driver and add a pressure roll as an outboard support for the punch body. With this setup, the back taper on the end of the punch could be ground without deflecting the punch body.

RESULT: The proposal worked perfectly, well within the tolerances specified. And there was a dramatic increase in the production rate, which was seven times as high as before.



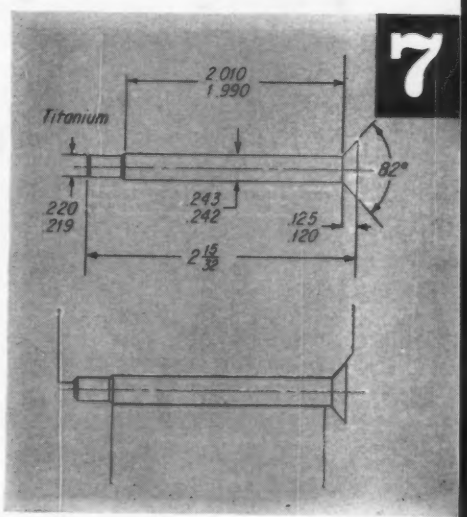
7

PROBLEM: A producer of aircraft fasteners received an order for titanium fasteners. Because of this metal's toughness, the shop had trouble grinding it. Conventional techniques were not adequate, causing excessive wheel wear, burning, heat checking, and surface roughness.

PROPOSAL: (1) Take advantage of the greatly increased cutting action that a crush-formed wheel gives.

(2) Install a dc drive on the grinder to maintain the constant peripheral speed needed to give ideal cutting action.

RESULT: The new technique eliminated all grinding problems. Up to 700 pieces could be machined per wheel dress. •



How to work Moly-Ti

By Donald A Honebrink
research engineer
Aero Space Division
The Boeing Co, Seattle

Building a glider which will orbit a man through space is a really "blue sky" project for any metalworking company. But out of machining and materials research for such a project may come the commonplace metalworking techniques of tomorrow.

One new refractory material, used at the moment almost exclusively by the aerospace industry, is Mo-0.5% Ti (99.340% molybdenum, 0.40-0.55% titanium, plus 0.01-0.04% carbon).

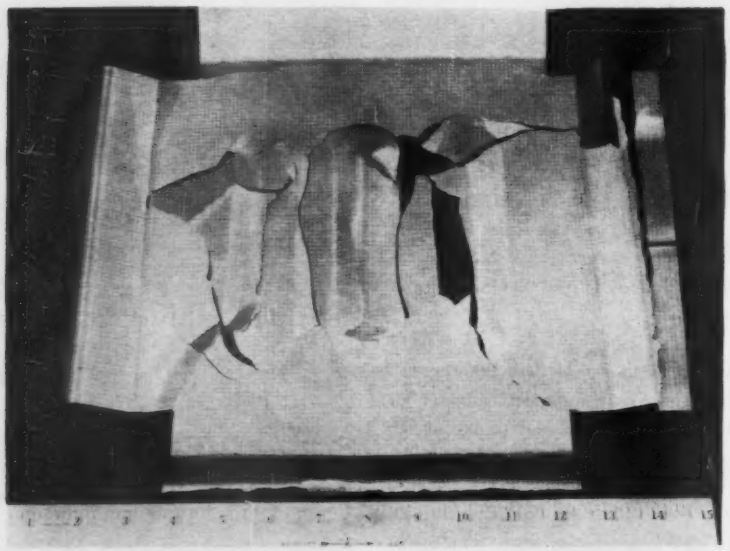
Boeing has been putting this promising (high strength above 2000 F) alloy through its paces — forming, shearing, bandsawing, abrasive cutoff, grinding, milling, and cleaning it in thin sheetmetal form.

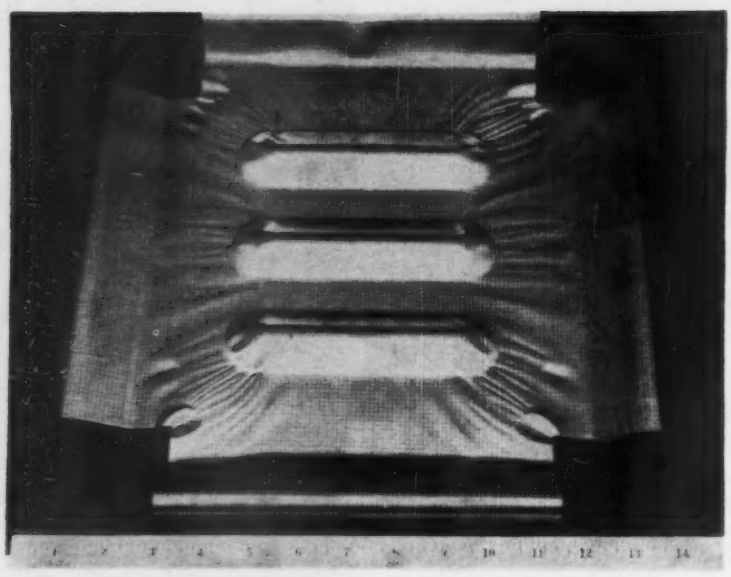
To determine the high-temperature mechanical properties of the alloy, we heated the specimens in a Boeing-built vacuum furnace at a rate of 5 F per second, then held them at test temperature for 10 minutes. Tensile tests (performed within the furnace) provided the data plotted on p105 (top, left).

The decrease in ductility as the test temperature was raised from room temperature to about 750 F (as indicated by the early drop-off in percent elongation) suggested the desirability of forming at or near room temperature.

How wrong this was, and how misleading conventional tests of formability were, is illustrated at the left. The 0.012-in.-thick sheet formed at room temperature fractured; that formed at 300 F did not. Yet Erickson tests at room temperature showed that formability was about equal in both cases. (In the Erickson test a piece of sheet metal, restrained except at the center, is deformed by a spherical-end plunger until fracture occurs. The depth of cup at fracture is a measure of the ductility, and formability, of the material).

Inspection of the grid marks on the panel formed at 300 F showed a maximum elongation of 10%.





Mo-0.5% Ti sheet fractured when formed at room temperature (top), but was formed successfully at 300 F (bottom). Conventional formability tests, however, had indicated that formability was just about equal in each case. Max elongation at 300 F was 10%

Minimum bend radius

A composite of nearly 400 bend tests is shown on page 105 (top, right). Specimens were given a 120° V-bend at temperatures from ambient to 1200 F and at ram rates of 0.01 to 100 ipm. (The test data plotted was obtained at a ram speed of 10 ipm; subsequent tests at 0.01 to 100 ipm showed that ram rate within this range had no effect of formability.)

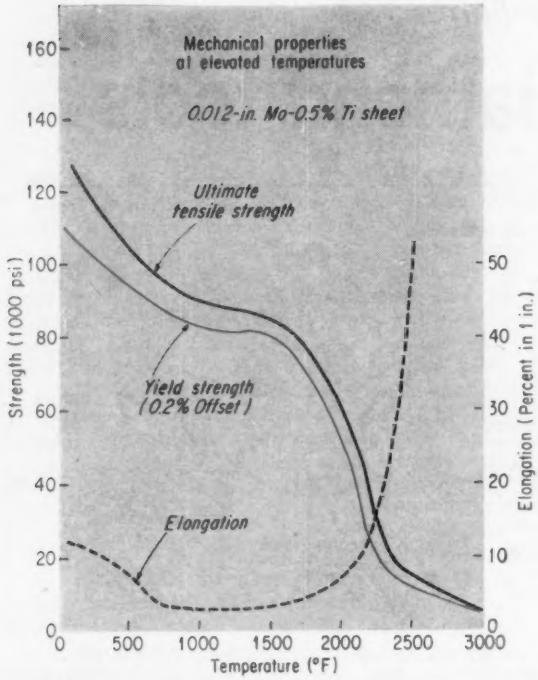
Clearly, a satisfactory forming area exists at an R/T (bend radius/thickness) of five at a temperature of 300 F. Forming in the red area resulted in occasional fractures.

Stress relief

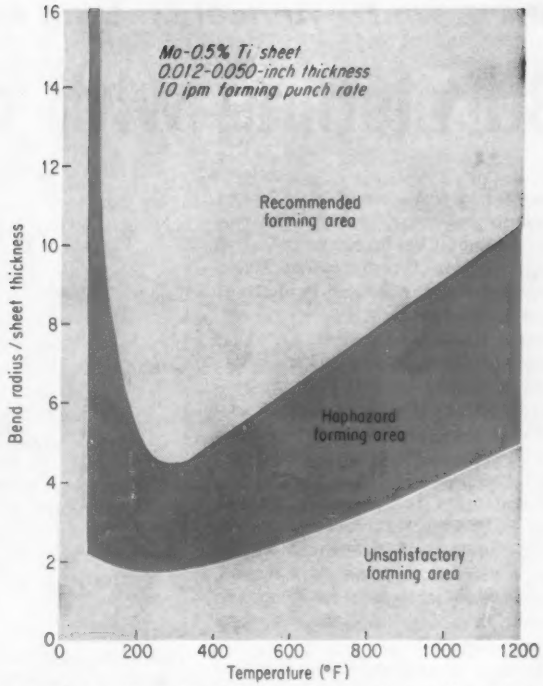
Stress relief studies were carried out by placing specimens in special restrainnig fixtures, enclosing them in a weld-sealed retort and subjecting them to temperatures of 1400 to 2000 F. We found that roughly 85 to 90% of the residual stress can be removed by heating the material to 1850 F, and that this results in no more than 20% recrystallization.

Cutting methods

All of our early test specimens were prepared by abrasive cutting or by milling. Because the material tends to delaminate during milling,



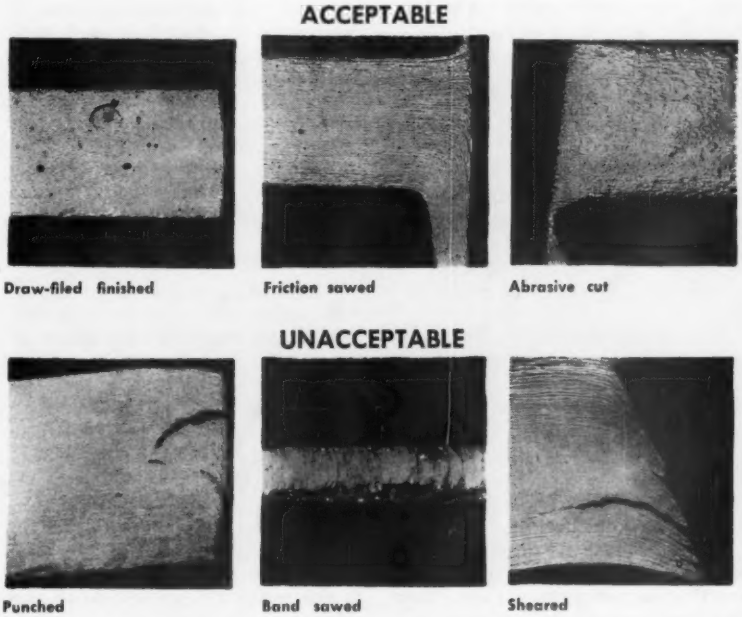
Alloy shows high strength at elevated temperatures, yet is light enough for space vehicle applications



Bend tests show allowable R/T (bend radius/thickness) ratios for Mo-0.5% Ti at elevated temperatures

it had to be backed up by, or sandwiched between, sheets of mild steel. Abrasive cutting and milling, however, are relatively expensive, so we looked into other cutting techniques. Shearing, punching, and band sawing were not successful. One method that proved moderately successful was sawing with a band saw blade that had been dressed off to one-third of the tooth depth. This provided a friction-cutting action, and we have used this technique for roughing prior to finish milling.

What happens to the edges of Mo-0.5% Ti sheet when it is cut is shown at the right. In addition to these cutting methods, we have done some preliminary work with electrical discharge machining (and have also used chemical milling) for blanking small parts. Both of these processes would be followed by vibratory finishing.



Delamination is main problem in cutting Mo-0.5% Ti sheetmetal

Cleaning and coating

To remove all discoloration and contamination we put all sheet metal parts through the following cleaning cycle: Vapor degrease (or emulsion clean and rinse), clean in hot alkaline detergent solution, pickle in HNO_3-HF or HNO_3-HCl bath, cold water rinse, de-smut in chromic sulfuric acid, cold water rinse, and hot water rinse.

Oxidation protection for Mo-0.5% Ti is presently obtained through a diffusion-siliconizing process. It is important that all corners and edges be radiused so that the protective moly-silicide layer will be continuous over the part.

The "as received" sheet material that we worked with showed spotty surface interstitial contamination, and hard nitride or carbonitride inclusions. These problems should be minimized as sheet production techniques are improved. •

ASME Winter Annual Meeting highlights

Burnishing with diamond tools

Diamond-tipped burnishing tools show no tool wear, produce controllable mirror-like finishes, and provide a residual compressive stress that improves the fatigue strength of a metal workpiece.

These three good reasons for using diamond-tipped burnishing tools were advanced by E H Hull of General Electric's Research Laboratory (Schenectady, NY) at the ASME Winter Annual Meeting in New York, Nov 26-30.

Burnishing has been practiced, said Hull, for centuries as a means of improving surface finish, using tool materials ranging from wood, bronze, and steel to bloodstone and agate. Now we have the diamond burnishing tool.

Several properties of the diamond make it effective as a burnishing tool material: The coefficient of friction between metals and diamond is low; an exceptionally smooth finish (less than 1 microinch) can be applied to diamond; diamond is as hard as any material known; and diamond is in ready supply, particularly since the development of man-made diamonds.

Making the tool

The burnishing tool was made from a ¾-carat natural diamond on which a small spherical section was ground to a ⅛-in. radius. The diamond was secured in a tool bit by a tight-fitting sleeve and dental cement.

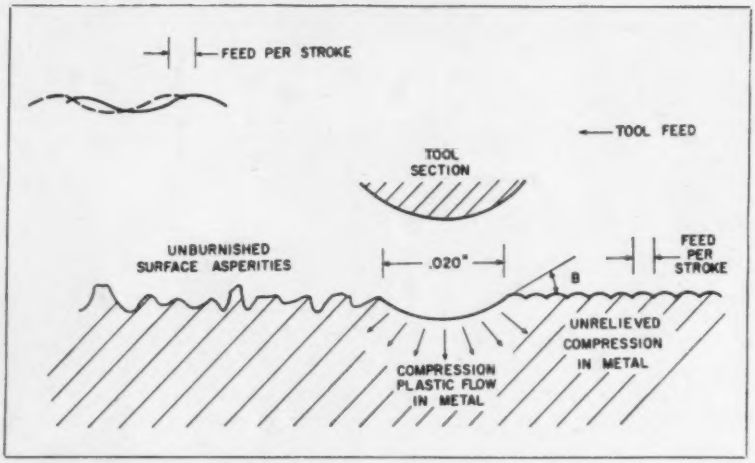
This simple tool was used in a shaper to burnish the surfaces of steel and brass samples. The surface finish was improved in all cases. On thin samples, say ⅛-in. thick, the burnished surface was convex both longitudinally and transversely, indicating a compressive stress in the surface in both directions.

Reburnishing these samples did not increase the convexity, suggesting that the compressive elastic limit had been reached in the first pass.

Other tools show wear

Four materials other than diamond were tried in a shaper as burnishing-tool materials on strips of Rh 37C die steel. These included a ceramic tool-bit material, a tungsten-carbide tool material, a high-alloy tool-bit steel—on all of which was ground a ¼-in.-dia spherical surface—and a standard ¼-in.-dia hardened-steel ball. All of these materials showed tool wear after burnishing one sample and produced an inferior surface finish on the specimen.

The diamond tool showed no change in its polished surface and produced a superior finish. Lubrication was used in all cases.



Diamond-tipped tool moves out toward reader and feeds from right to left in this simplified representation of the burnishing process. Effect of successive strokes is shown at upper left in this sketch

The burnishing process

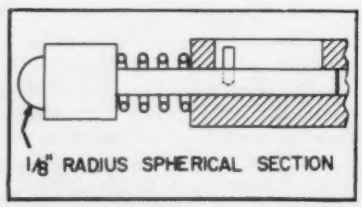
Illustrated above is a simplified representation of the burnishing process. A tool of the section shown is forced into contact with the work and moved in the direction of the reader. Ahead of, beside, and under the tool, there is compressive plastic flow which relieves itself down to the elastic limit after the tool has passed.

During the process, the valleys between the surface peaks (or asperities), if not too deep, will be filled as the peaks are pushed down and sideways.

Smoothness of the finished surface depends upon several factors, one of which is width of the furrows. This is determined by the feed and the leaving angle B (see sketch).

Toolroom lathe used

A toolroom lathe on which feed rates may be varied independently



Spring-fed burnishing tool can be used to burnish slightly irregular work. Small changes in position of work with respect to tool will not cause large changes in burnishing pressure

of the workpiece surface speed makes a convenient tool for burnishing flat or cylindrical surfaces. Feeds of 0.0005 to 0.004 ipr produce reasonable burnishing results. One pass is usually sufficient, and the finer feeds, in general, produce finer finishes. Speeds are relatively unimportant; to burnish a 1-in. cylinder, speeds of a few hundred to a few thousand rpm may be used.

The burnishing tool is set in the tool post so that it contacts the work on the horizontal center line. In-feed of the tool should be set to give a track a few thousandths wide. This varies with material hardness, diamond-tool diameter, original surface roughness, and so on.

Nearly all ductile metals may be burnished—steel, aluminum, copper,

stainless, brass, and the like. Titanium, however, cannot be burnished; it sticks to the diamond. Lubricants should be chosen for the particular material. In some instances a second burnishing pass, with the feed reversed but with the same tool settings, improves the finish.

Steels as hard as Rh 65C can be burnished by using a smaller radius spherical section on the diamond tool. Radiuses down to 0.030 have been used. A diamond tool ground to a cylindrical surface, rather than spherical, usually produces superior results on cylindrical pieces. The axis of the tool should be presented to the work at an angle skewed in a vertical plane to the work axis. In this way, the leaving angle B may be reduced, thereby improving the degree of surface finish.

Spring-fed tool

A spring-fed burnishing tool (p106) is effective for burnishing slightly irregular work because small changes in the position of the work with respect to the tool will not cause large changes in burnishing-tool pressure. Use of a low-stiffness spring with considerable pre-compression will minimize pressure changes due to runout.

Grinding with abrasive disks

When an abrasive disk cuts mild steel, each abrasive grit which is in contact with the metal acts as an individual cutting tool. When an abrasive disk cuts stainless steel, micropoints on the surface of each grit act as individual cutting tools. These points were brought out in a paper presented at the ASME meeting by W A Mohun, an industrial consultant.

In the third part of his four-part presentation, Mohun discussed the reasons abrasive grinding disks fail. He showed that the worn surface of a grit has a camber which causes decreasing depth of cut, leading to glazing.

Unlike formed cutting tools, the lower surface of a grit is developed by wear. Upon examination, the flat thus formed appears to be a plane surface that is parallel to the direction of tool motion. This would give a zero clearance angle, and since no vertical force is applied, there should be negligible friction between grit and metal.

In actual grinding, however, the plane dips down toward the trailing edge of the grit; this Mohun calls attritious camber. He points out that disks stop cutting because attritious camber gradually reduces depth of cut to the vanishing point, and that this process is delayed by removal of the larger flats through self-dressing on mild steel or through micro-dressing on stainless. On mild steel the disks fail because the flats become too large; on stainless the disks fail because the microflats become too numerous.

Blackall Award Winner

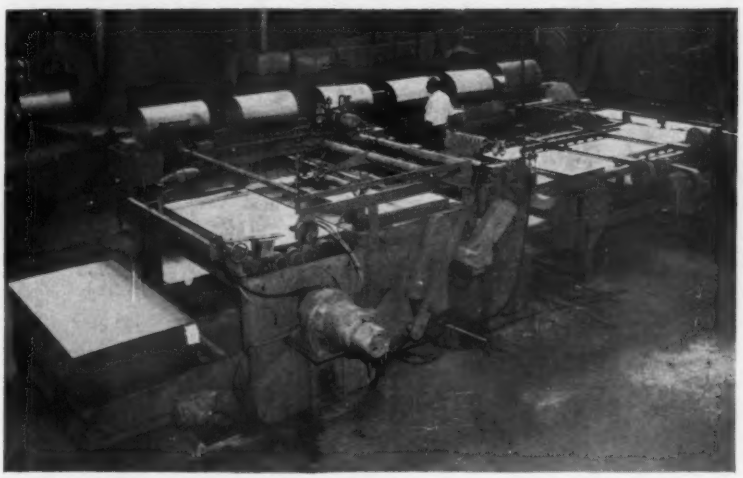
At the President's Luncheon, Nov 27, the ASME conferred the Blackall Machine Tool and Gage Award to Joseph R Roubik of Kearney & Trecker Corp. •

Automatic welder speeds drum fabrication

A unique new seam welder developed for automatic fabrication of cold-rolled-steel drums has gone into operation at United States Steel Products Division, U S Steel Corp, Los Angeles, Calif.

Most significant feature of the new setup is the use of tucking rolls with a Z-bar instead of the conventional cage or hour-glass roll for holding sheet during the operation. With the Z-bar, which prevents the rolled sheet from opening up and which governs the width of weld, different diameter drums can be seam welded without changing the setup.

Result is a drastic reduction in setup time in drum fabrication, compared with that required in conventional machines that require a different cage or set of rolls for each different size container.



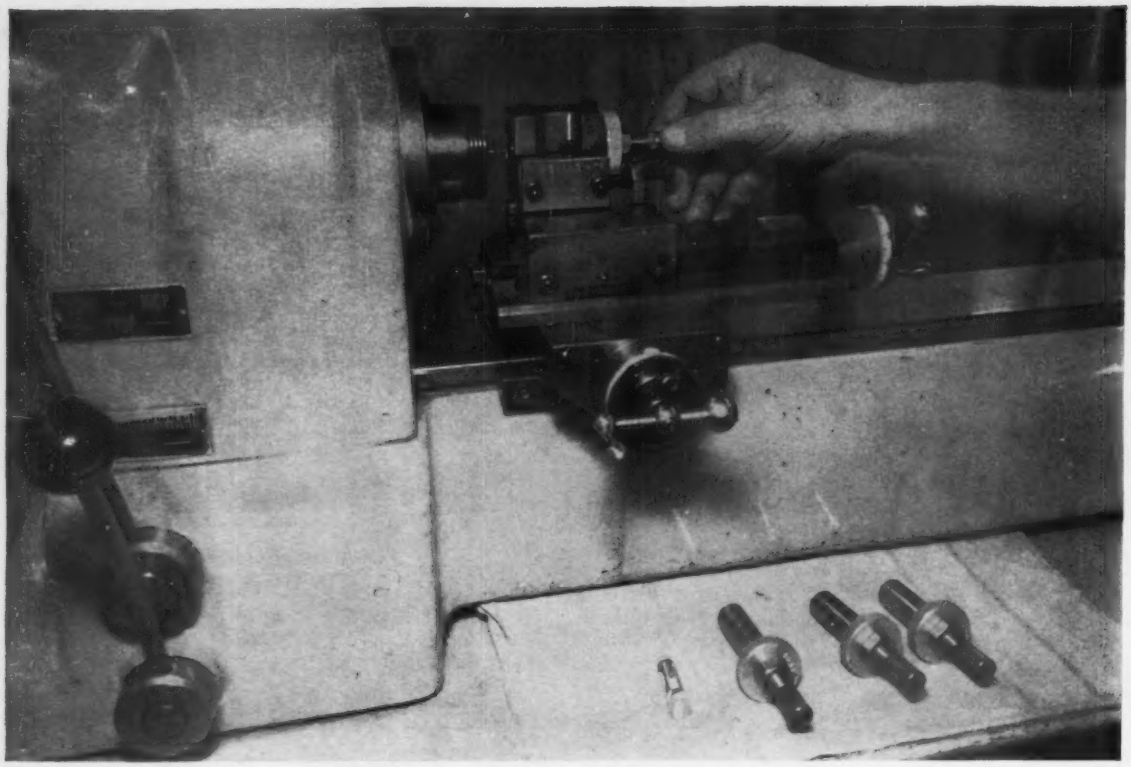
One operator controls drum production in this automatic setup that includes a sheet slitting station (lower left) edge grinding, rolling, and seam welding. Work progresses through U-shaped layout. Welded drum shells emerge at upper left

Sizes from 18 to 22½ in.

U S Steel runs cylindrical sections in sizes from 18 to 22½ in. in diameter (30 to 55-gallon drums) at a rate of 600 per hour, and the machine can handle larger sizes if necessary. Special insulated primary windings were developed specifically for this application to permit a 450-KV capacity at 100% duty cycle. Acme Welder Co (Los Angeles) and the Carando Machine Works (Stockton), which built the mechanical elements, worked to U S Steel's specifications.

By tieing the new automatic welder in with automatic slitting, edge grinding, and rolling stations, U S Steel Products has cut manufacturing costs 50%.

In operation, cold-rolled sheets are automatically fed to the slitter, where the two ends are trimmed. Edges are then ground to clean the surfaces for welding. Sheets are then rolled and fed to the welder. After they are lap welded longitudinally in the automatic seam welder, the drum shells move onto a conveyor for automatic transfer to other operations. This is all part of a $2-million expansion program. •

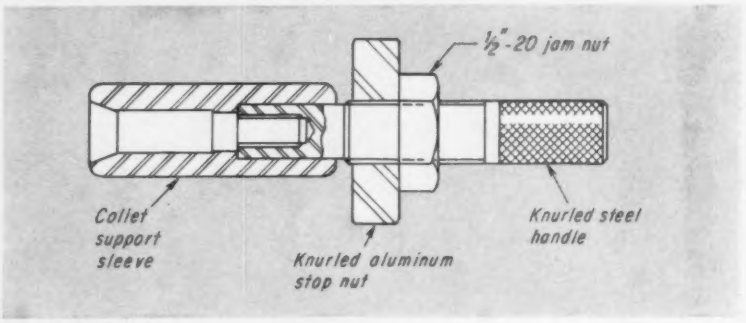


Drilling small holes on a lathe

By John Dow
Superintendent of manufacturing
Ridgway Plant, Aeronautical Division
Minneapolis-Honeywell Regulator Co
Minneapolis

Holes as small as 0.010 inch in diameter can be drilled accurately, or reamed and faced, or counterbored in small toolmaker lathes. All that's needed is a simple manually controlled attachment.

With it, holes up to five diameters deep can be drilled in 0.020-in.-diameter rods held in a collet chuck in the spindle of a Hardinge lathe—to ±0.0002 in. tolerance on the bore diameter.



Bearing block is mounted on a tapered base so that it can be precisely centered with the axis of the lathe spindle. Toolholder is held in a ball bushing, so that only fingertip touch is required

The attachment

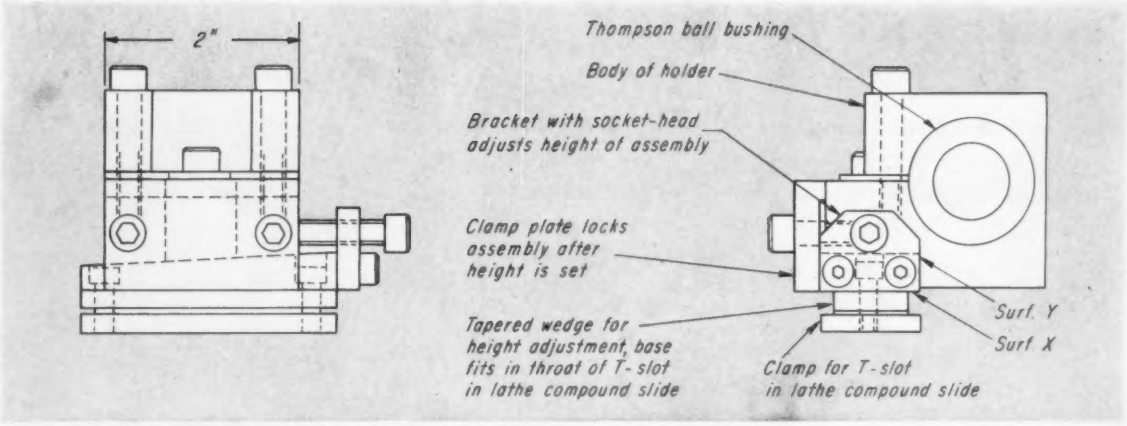
Basically, the attachment consists of a tool guide block on a tapered base, which in turn is mounted on the lathe compound. The block carries a ¾ in. ID ball bushing horizontally in line with the axis of the lathe spindle. The tapered base allows a small drill or other tool to be centered precisely with the axis of the work.

Each tool for a given series of operations has its own toolholder, consisting of a Levine split collet, a bearing lapped to a fine slip fit in the tool block bushing, a stop nut, and knurled handle. These toolholders are interchanged in the block when the tool itself is changed.

With this arrangement, each tool can be fed into the work with fingertip sensitivity—so that frequently operations can be performed with more accuracy and with less tool breakage than can be achieved with sensitive drillpresses.

A typical series of operations with this lathe setup:

- Slab-face the end of a workpiece to hold constant depth (a conventional Gorton slab engraving cutter is generally used for this).
- Center drill (with a Gorton single-point engraving cutter).


2"
Thompson ball bushing
Body of holder
Bracket with socket-head adjusts height of assembly
Clamp plate locks assembly after height is set
Tapered wedge for height adjustment, base fits in throat of T-slot in lathe compound slide
Surf. Y
Surf. X
Clamp for T-slot in lathe compound slide

Collet support sleeve for toolholder is made of tool steel, and is hardened to Rh 58-62 C before it is ground to precision tolerance. Tool is held in a Levine collet centered in bore at outer end of sleeve

• Rough drill (with a twist drill or small spade drill 0.001 to 0.002 in. smaller in diameter than the finished hole size.

• Ream hole to size, using a carefully selected twist drill of correct diameter, accurately centered in the toolholder collet.

• Slab-face the end of the workpiece to remove burr, using the same tool as for the first operation (Gorton slab-engraving cutter).

Because the OD of the collet support sleeve on the toolholder is a close slip fit in the ball bushing fitted to the block, it can easily be moved longitudinally by the operator, who grips the end of the knurled steel handle on the holder. In this way, the operator can feel with his fingertips whether the tool is cutting properly, or if feed is too rapid.

Precision grinding

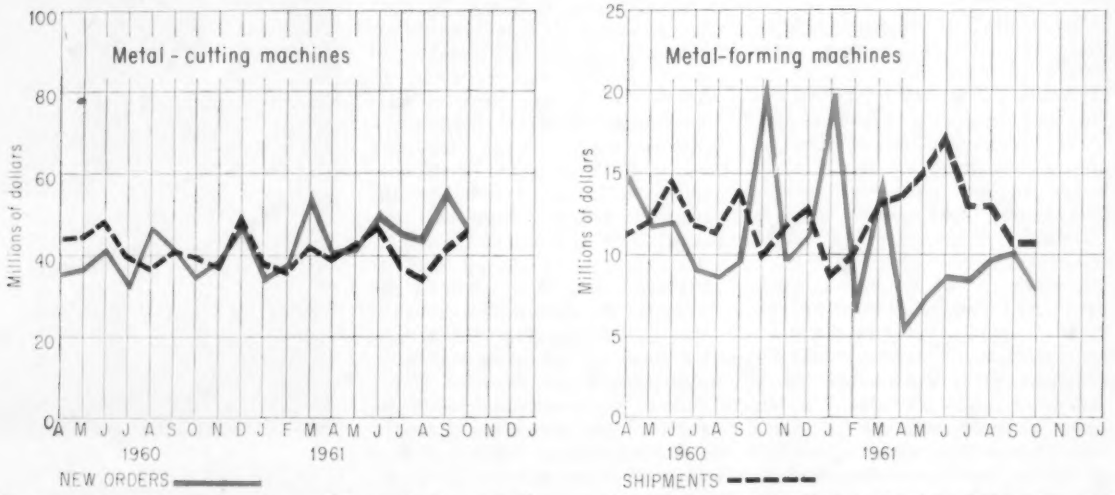
For the setup shown, the collet support sleeves are precision ground to 0.7495 in. diameter to within +0.0000, −0.0005 in., and are finished as finely as possible so as to move smoothly within the 0.750-in. ID, 2-in.-long Thompson ball bushing.

This bushing is bored and ground to provide a socket 0.3150-in. ID, to within ±0.0001 in., and 1.17 in. deep at one end to fit the Levine precision collet sleeve, which is ground to a slip fit concentric with the OD of the sleeve within 0.0002 in. TIR.

The bore in the other end of the collet sleeve is ground to a slip fit on the 0.437-in. diameter, 1.3-in.-long reduced diameter on the forward end of the knurled and threaded steel handle. The forward end of this handle is also drilled and tapped.

The center portion of this handle is threaded to take a knurled aluminum stop nut and a smaller jam nut —so that the holder can be set to drill, ream, counterbore or face to a preset depth. •

NMTBA Index of machine tool new orders and shipments



Net new orders for metal-cutting machine tools dropped off to $48,500,000 in October, down from $55,650,000 in September, according to preliminary figures from the NMTBA. Shipments of metal-cutting machine tools rose from $41,200,000 in September to $46,050,000 in October. Orders for metal-forming machine tools declined to $8,450,000 in October from a September level of $10,950,000. Shipments rose from $10,700,000 in September to $10,800,000 in October

Tried X-ray PAPER yet?

Here is how Convair-San Diego is saving $13,000 or so a year merely by substituting X-ray paper for X-ray film, with little or no loss in quality of inspection of less-critical parts

By G R Bailey, supervisor,
Quality Control Laboratory
General Dynamics/Convair,
San Diego, Calif

Admittedly, X-ray inspection isn't cheap, no matter how it is done. But then again, there is nothing that can quite take its place in assuring the quality of critical aircraft and missile components.

Convair-San Diego, looking for a way to cut the cost of such inspection with only a minimal loss in quality of the inspection process itself, has come up with the answer: substitution of X-ray paper for much-more-costly film.

Convair is the first to admit that paper has its limitations, that it shouldn't replace film in inspection of really critical parts. Among its limitations: (1) Maximum resolution attainable is about 4%, compared with 2% for film, (2) Paper has a tendency to curl at the edges after it is processed, making flat storage difficult, and (3) It is difficult to process automatically (most X-ray film processors are not equipped to handle its bulkiness).

The advantages

But aside from those drawbacks, paper has a lot of advantages over film—advantages that put it on the credit side of the ledger for all but the most critical applications.

For instance: paper requires no viewer—the image on X-ray paper is just as easy to examine as any photograph; images are easy to interpret — it doesn't take a trained radiographer to do the job.

The paper itself is "CAWO," made by Photo Chemiche Werke of Germany. Originally designed for medical X-rays, it has acceptable radiographic resolution and sensitivity, yet costs only 20¢ a square foot, compared with 58¢ for X-ray film. In just one year, Convair-San Diego has saved something like $13,000 by substituting X-ray paper for film wherever possible.

Basic techniques for using X-ray paper are the same as those for standard X-ray film, and exposure speeds are comparable to those of Eastman Kodak Type AA film. Processing solutions, time involved, and temperatures are similar to those for conventional X-ray film processing, except that thorough rinsing and washing are essential to prevent fixer stains. And care must be taken in drying because excessive heat could cause embrittlement and eventual cracking of the emulsion.

But even this problem is easily solved by removing the paper from the dryer while it is still slightly damp, and then stacking the shots front-to-back on a flat surface.

Honeycomb inspection

Paper has been found to be ideal for radiographic inspection of honeycomb panels (not only manufacturing defects, but for possible water contamination of the honeycomb after it is in service on an aircraft); for checking ballistics for powder charges and the location of safety or shear pins; for inspecting noncritical castings and electronic components; and for general trouble shooting to assist in failure analysis.

Actually, Convair-San Diego hit upon X-ray paper as the solution to the high cost of X-ray film only after a period of trial and error. Obviously, nothing could take the place of X-ray inspection for sheer efficiency in finding flaws in vital aircraft and missile components, and labor costs of such an inspection could not be reduced. There was only one way to cut costs—to find a substitute for film, the single most expensive item in X-ray inspection.

Fluoroscopy was selected as a possible substitute, and while it did eliminate the cost of film, it could not be used in examining inaccessible parts, and its resolution and sensitivity weren't good enough.

There is no question about the need for more and more reliability in the building of today's aircraft, and there is no question about the high cost of achieving that reliability. Substitution of paper for X-ray film helps maintain reliability, and it cuts the cost of achieving it. •

X-raying with paper at Convair-San Diego: Honeycomb assemblies are 100% X-ray inspected for damaged core, node bond failure, core-to-edge member voids, improperly placed inserts, and many other possible defects

Gang planing in multiple setups on magnetic chucks on 48 x 43-in. double-housing G & L planer

Magnetic chucks for planing

By Harry C Soukup
Manufacturing manager
Giddings & Lewis Machine Tool Co
Fond du Lac, Wis

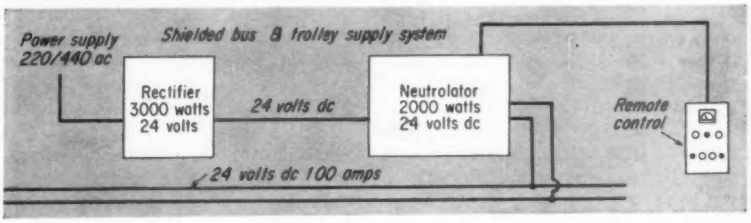
For five years, magnetic chucking for planing operations has been put through its paces at Giddings & Lewis. The report: safe, economical, altogether satisfactory.

The chucks are used on a G & L 48 x 43-in., 50-hp extra heavy duty double-housing planer with a 20-ft-long table.

The chuck itself is made up of nine individual 24-in.-square Sundstrand "Power Grip" chucks, spaced 1-inch apart in line along one side of the planer table.

Beside the last chuck in line is a positive stop that keeps the work from being pushed off the chucks should the power supply fail, or if cutting pressure exceeds the holding power of the magnets. This stop is arranged so that crossbars of different heights can be employed to suit workpieces of varying thickness.

Power supply to the bus and trolley system on the planer (which feeds current to the individual chucks) includes a 3000-watt-capacity rectifier to convert 60-cycle, 220/440 volts ac shop power to 24 volts dc for the chucks, and a 2000-watt-capacity dc Neutrolator to provide adjustable holding power for the magnets.



Simple circuit provides power to nine individual chucks from a 220/440 ac power supply line. Remote control station at the operator's working position provides for adjustment of chucking power

"Feedrail" bus and trolley electrical pickup on the planer table has capacity for 100 amps at 24 volts dc while operating at 400 fpm table speed.

Designed to finish-plane flame-hardened bed, head and saddle ways for machine tools, it was estimated that magnetic chucking would save more than $4000 a year. But this saving was increased at least 50% by using special Davis gang tools, which allow multiple cuts to be taken on the long ways during each traverse of the table. Result: the installation paid for itself in less than three years.

If two ways are positioned on the table during each setup, handling time per setup is cut about 80%—from 257 to 49 minutes. If four ways are loaded on the chucks at once, the loading, shimming, alignment and unloading time is cut from 510 to 98 minutes.

Not only will this setup plane machine ways, it can plane flat steel cover plates, which are done as many as 15 at a time.

Chips usually do not fly off the work with magnetic clamping. Instead, they tend to cling to the chuck surfaces, but they are easily brushed off when the power is turned off.

Magnetic chucking, while not adaptable to run-of-mine planing, has proved its value in holding long, straight (as well as flat) parts, and is especially good for machining small job lots. •

How to cut screw machine rejects

Here is a quality control program that not only cuts rejects to almost nothing, but which also serves as a basis for choosing the right machine and tooling for a job, and even for operator training

By L L Byrd,
quality control engineer
Appliance Control Dept
General Electric Co
Morrison, Ill

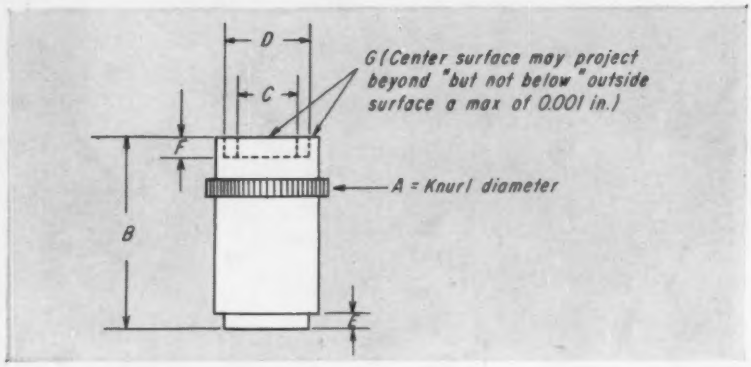


Fig. 1—Typical screw-machine part shown has seven critical dimensions. They are checked by the operator according to process control plan (across page)

Fewer than 0.1% rejects in 40,000,000 screw machine parts! That's the record chalked up over the last 18 months with a stringent quality control program at GE's Appliance Control Department.

It's far more than a run-of-the-mill monitoring of parts quality on the production line. GE's program is the basis for selecting the right machine and tooling for a job, for correcting dimensional and other defects in the pilot-run stage . . . and it has even changed operator attitudes toward the value of frequent quality control checks.

The result: When any part goes into full production, it does so with the right tooling on the right screw machine, with a quality-control-conscious, trained operator, and with every assurance that it will meet all specifications.

Success of such a program depends primarily upon selection of the screw machine and tooling. This begins with a thorough analysis of the part to be made. Here, previous experience comes into play.

Check past results

For instance, the previous supplier of a part may have had trouble with burr removal, with poor surface finish, or with too high a percentage of bar ends. To correct these problems, we would specify that a burr remover be added to the tooling, that the coolant be changed to improve finish, and that a mechanism be provided to remove bar ends.

Basic? Yes, but it pays to consider the obvious in setting up a quality control program. A production machine must perform a given function, yet this function is often poorly defined. It is far better to find out if a machine will do the job *before* it goes to work than to install it in a line only to find that it cannot turn out a product that meets specifications.

Inadequate part drawings, it was found, could sometimes be at fault. These were redrawn for clarity.

Once this was done, we made a general dimensional review of all parts—cut lengths, diameters, threads and knurls (the basic characteristics of screw machine parts). Object: to establish an AQL (acceptable quality level) for each of these.

Boiled down to its essence, AQL is nothing more than the percentage of defects that can be tolerated, considering that a defective part can ruin a subassembly, or even a final assembly.

For example, if each defective part ultimately causes a 10-minute shutdown of an assembly line that costs $7 a minute to operate, that part has cost the company $70 plus the cost of making it (this may be quite small). If the company can afford to have only one part in 10,000 cost $70 in downtime of its final assembly line, then the AQL is 0.01%.

If, however, a defective part is quickly detected, say before it is assembled with any other parts, or at most in a minor subassembly, then the AQL may be 2.5% or higher (assuming that the cost of making the defective part itself is small).

Here is how GE set up acceptable quality levels for production of screw machine parts. If a machine or tooling setup could not produce parts that would meet these AQL's, they were rejected.

- The total of *all* defective characteristics must not exceed 2.5% AQL. In other words, if the diameter were 2.5% defective, all other characteristics (such as length, hole depth, pitch diameter) would have to be virtually perfect.
- "Missed operation" characteristics (holes, threads or grooves left out) must not exceed 0.1% AQL limit.
- Chips, spirals of material, oils and other lubricants must be removed from the parts. This removal must be 100% effective, based on a 300-piece random sample.
- Visual or comparison characteristics must be equal to or better than those of the approved sample or master. This must be 100% effective, based on a 25-piece sampling.
- Because bar ends ("short parts") are often produced during automatic bar feeding, AQL's must be established for individual parts.

Dimensional accuracy

At GE, any part with a dimension that exceeded the tolerance shown in the part drawing by 0.0001 in. or more was designated defective—an arbitrary limit set for initial stages of operation.

In cases where the measuring instrument did not read directly in tenths, we used the value in which it read. Internal pitch diameter gages, for instance, have a scale division of 0.00025 in. In this case, a part would not be considered defective unless it read one full scale division (0.00025 in.) beyond the

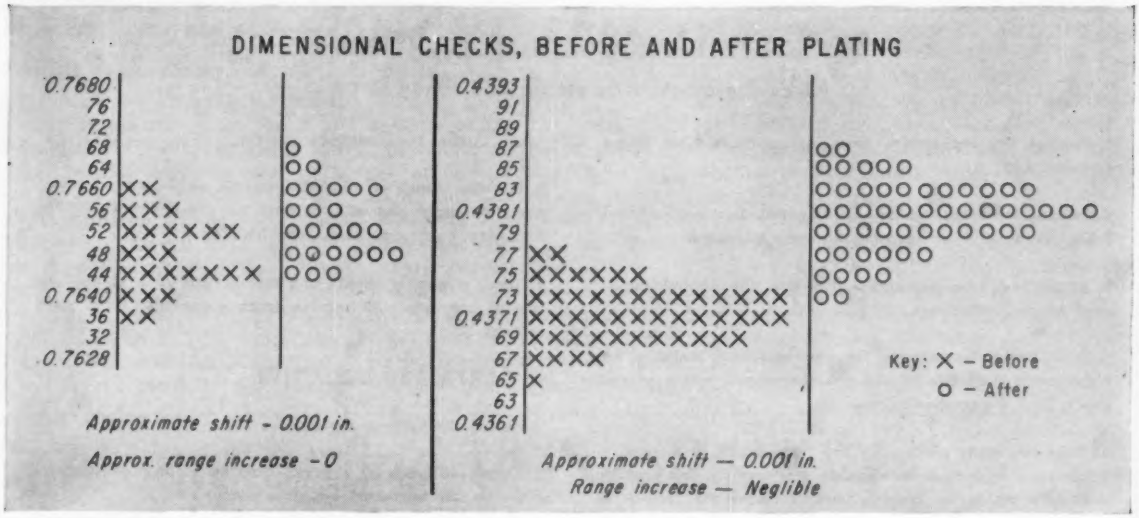


Fig. 2—Distributions of a cut length and a cut diameter are plotted before and after plating. The shift is compensated for in setting up the operator's specifications in the fabrication process control plan shown below

specification limit. This gave the operator the benefit of the doubt, more than making-up in operator cooperation what it cost in tolerance.

For guidance in use of fixed-limit gages (pin gages, thread gages, ring gages), any part would be considered defective which would accept the no-go member with light finger pressure, or which would not accept the go member with light finger pressure.

Military Standard 105 B was the criteria—in case of controversy—for determining the size of the sample and the number of defectives allowable in a given lot of parts. But the Quality Control Department reserved final say-so in deciding about a controversial characteristic.

Machine evaluation

In evaluating the performance of a screw machine, it is necessary to differentiate between variations from the norm caused by the machine itself and those caused by, say, variations in raw materials, in setups, or in tool wear. Errors in measurement, which certainly must be considered, are included in basic machine variation.

After eliminating such obvious errors as loose cutting tools and coolant failure, we defined basic machine variation as the variation found in 300 consecutive samples taken from a single setup, without any adjustment being made, and with raw material taken from a single homogeneous lot.

This definition minimizes, or even eliminates, variations caused by differences in tool wear, setup, or other factors.

Distributions for a cut length and a cut diameter (before and after finishing) of the part diagrammed in Fig. 1 are shown as histograms in Fig. 2. Note that the basic machine variation is substantially less than the specified drawing limits.

Note also that each of these two dimensions had dimensional shifts (caused by the electroplated finishes) but no significant range increase. These shifts are made from the drawing specification, and are shown as the specification in the above chart.

These distributions were found during the pilot run, and the decision to shift the operator's specifications was made at that time.

Operator acceptance

Biggest problem we had in training operators was getting them to make frequent checks of certain characteristics, and to take prompt corrective action.

We found the best way to do this was to compare measuring a given characteristic to driving an auto-

FABRICATION PROCESS CONTROL PLAN

Part name *Core* Device *3ARR3* Date *11/23/60*
Drawing No. *742A214* Part No. *2* Sheet No. *1*
Operation *Screw machine* Drawing rev. *15* Issued by: *L. Byrd*

Item No.	Characteristic	Gages and instructions	Checked by	Frequency	Records kept
A	04425/04465 spec. 0.4430/04460 control limits	Snap dial indicator set to 0.443 with master	Operator	Q.C. plan	Chart
B	0.763/0.767 spec. 0.764/0.766 C.L.	Snap dial indicator set to 0.764 with master	Operator	Q.C. plan	Chart
C	0.236/0.232 spec. gage C.L.	Special gage MEC 4485 B	Operator	5/su-l/bar	None
D	0.377/0.373 spec. gage C.L.	Special gage MEC 4485 B	Operator	5/su-l/bar	None
E	0055/0.059 spec. 00555/00585 C.L.	Dial indicator & plate	Operator	2/su-l/bar	None
F	0078/0.072 spec. 00725/00775	Use center surface; do not use ring	Operator	2/su-l/bar	None
G	0.000/0.001 spec. 0.0005/0.0015 C.L.	Special gage set to zero with surface plate	Operator	2/su-l/bar	None

ROUTINE PRODUCTION CONTROL

(Once the machine is set up and ready to run)

1. Produce five consecutive parts and measure them to the nearest 0.0001 in.

2. Plot the five measurements on a control chart, with control limits set at 50% of specified drawing tolerance.

3. If all five measurements fall within the control limits, start the production run.

4. If all five measurements are outside control limits, make adjustments until five consecutive pieces fall within control limits. Start the production run.

5. Take two parts per bar (or two parts every 20 minutes if a bar runs more than 20 minutes). Measure the first part — if it falls within the control limits, continue the run. (It is not necessary to measure the second part if the first is okay). If the first part is outside the control limits, measure the second part and if it falls within limits continue the run. If both parts are out of control, stop the machine and adjust the tooling until five consecutive parts are produced within control limits. Then continue the run.

6. Plot the results of all measurements on the control chart, identifying each plot with the date and the operator's initials. Note any quality problems on chart.

7. Have a quality control engineer review each chart. (This is done only after 160 or more hours of operation for a given part at GE).

IF PARTS ARE DEFECTIVE . . .

1. Divide the suspected parts into lots of 3000 pieces or less.

2. Take 150 parts at random from each lot and measure them on all suspected characteristics.

3. If more than eight pieces in the lot of 150 random parts are outside the drawing limits, it is up to the quality control engineer to decide whether to scrap the entire run, or to sort out the defectives from the entire run.

mobile: A good driver doesn't wait until his right front wheel goes off onto the shoulder of a road before correcting his steering. Instead, he corrects constantly to stay in the middle of his lane.

By the same token, a good machine operator does not wait until he is producing defectives before he makes an adjustment.

When we established arbitrary control limits that were inside the drawing limits, the operators reacted violently, thinking that Quality Control was tightening tolerances. Some of them insisted that a setup is adequate when it produces a sample that is just inside the specs.

Proof of the pudding

Because the operators were confusing the question of whether or not a particular sample was within the drawing specification, and because some of them maintained that a setup could produce thousands of parts to drawing specifications with only routine checks and minor adjustments, we decided to let the operators test their pet theories.

First, we actually let them use the drawing limit as the control limit in running 2000 to 3000 parts. Then we had them take 50 random samples from this run and plot them.

Then we had them use only the center 50% of drawing tolerance as the control limit, and make another run of 2000 to 3000 parts. Comparing the resulting frequency distribution from the two runs, they were strongly impressed with the power of control limits.

We also made up a detailed process control plan (p113) which lists the dimensions for operator control, and shows the control limits for selected dimensions.

Making a pilot run

Each new part required a pilot run —to show whether the part was properly tooled, and whether it could be set up and run under normal production conditions.

To avoid controversy, a pilot run was defined as the first 3000 pieces produced with either new tooling (original or replacement), a new machine, or with a new operator or setup man.

A pilot run was also required for any part that had not been produced in the last 12 months.

During each pilot run, quality checks were made in accordance with the process control plan for the part. If at any point during the run it developed that the characteristics could not fall within the control limits, or if the dimension consistenly fell on either the plus or the minus side, the run was discontinued until corrections were made.

In cases like this, a pilot run would be corrected again and again until characteristics fell within limits.

After a pilot run, a random sample of 50 parts was taken before secondary operations such as burr removal, electroplating or burnishing. The rest of the parts were processed through the secondary operation, and another 50-part sample taken.

Then the characteristics of each of these two sets of samples were measured, to determine if the secondary operation had either shifted the nominal value of a given characteristic, or had increased the variation of the characteristic. If such a shift did occur, a compensating shift was made at the machine to allow for the effect of the secondary operation.

If an increase in variation occurred (producing defective parts after the secondary operation), the secondary operation was modified to reduce the variation. And, in some cases, the drawing tolerance was increased if the product design was such that it could permit a greater variation.

In this way, the pilot runs proved out our quality plan. Either the specs were met, or corrective action was taken. Thus Quality Control would release a part for production only if parts were meeting specs on the pilot run.

After a pilot run was completed, all regularly scheduled production was considered "normal," so that the machine operator could carry out regular quality control procedure and insure proper setup.

This procedure (above) consists of random sampling at specified time intervals, also on each new bar of

stock, to make sure that parts remain within control limits.

Analyzing effectiveness

As a final step in quality control, the quality control plan itself is analyzed to see if it is producing the desired results. Here is how it is done:

• **Parts audit**—At random intervals (not less than once a week and not more than five times a week) an auditing inspector selects 25 pieces from each machine running at the time of the audit. All characteristics are measured, the findings are plotted, and a record is sent to the quality control engineer. If an out-of-control condition is indicated, the QC engineer checks with the foreman to make sure that corrective action is taken.

• **Gage audit**—The same inspector also audits all gages used in each operation, notifying the QC engineer if a gage needs replacement or maintenance. Corrective action is then taken and, if necessary, the gage is replaced.

• **Conformance-to-plan audit** — At random intervals of not less than once each week, the QC engineer checks the performance of functional elements of the plan, reporting conformance or non-conformance to the appropriate managers, and recommendations for corrective action.

This audit includes parts checks, parts handling and identification, setup procedures and checks, gaging frequency, control chart data and any other item vital to maintaining quality levels.

• **Conformance-to-specification audit** —The percentage of parts conforming to specifications (based on stock audits, normal line inspection, and screw-machine area audits) becomes the yardstick by which the effectiveness of the plan, and of improved quality, is measured. •

Contour turning to "tenths"

Just one pass with a tracer attachment on a lathe is all that's needed to finish-turn and groove the contours of aluminum sleeves for missile fuel metering valves—a job that once required nine finish-grinding operations. End result: better quality and a 25 to 30% increase in production rates.

Five O-ring grooves, five stepped diameters and three angles make up the contours, which are held within 0.0006-in. total tolerance on diameters, and to a surface finish of 32 microinches rms.

Los Angeles' Grindley Manufacturing Co does the job with a True-Trace "Synchro-Turn" tracing attachment on a 12-inch Logan lathe. The tracer setup is so installed that the attachment doesn't interfere with ordinary lathe operations, and the standard compound remains intact (with the attachment mounted at the back of the lathe above the bed). In this way, the cross slide feeds in at 90° to the spindle axis.

Full capacity of bed

The tracer templet holder—usually an integral part of the attachment —is mounted separately on the lathe headstock, so that the tracer attachment can be used to the full capacity of the bed length. As a result, long parts can be contour-turned in two or more stages, if desired, by machining them in increments with several templets.

A flat templet and a single-point, flat-nosed carbide toolbit are used in finish-turning the valve sleeves. The tracer attachment provides coordinated feed rates in all directions, achieving fine finishes which once required grinding.

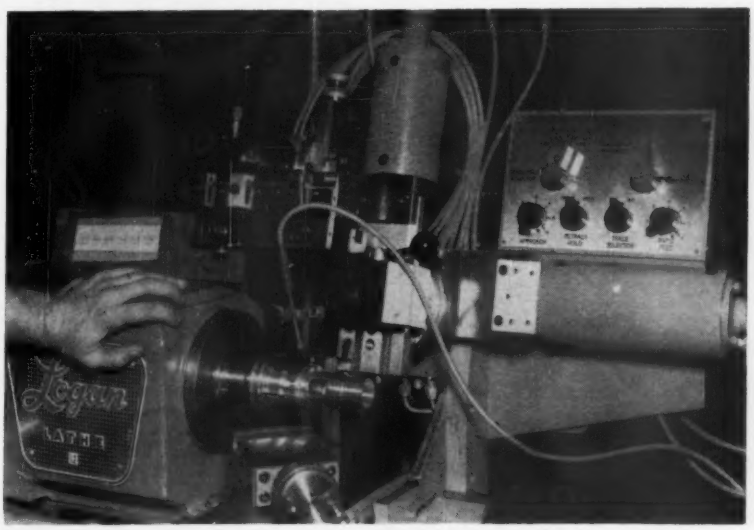
Before finishing, parts are rough-machined on a Warner & Swasey automatic equipped with form tools for fast removal of heavy stock.

A 1.500-in.-diameter bore, provided in the roughing setup, acts as a locating surface for finish-machining parts as they are held in an expanding arbor. Concentricity of O-ring grooves and other OD contours with the bore is held within 0.001 in. TIR in finishing.

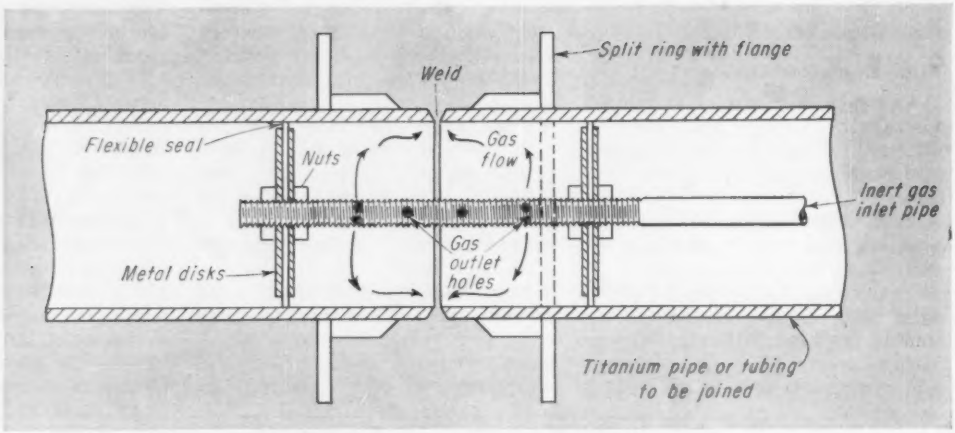
Two O-ring grooves are finished on the flanged (large) end of the sleeve. Each groove is 0.141 in. wide, and 0.004 to 0.005 inch of stock is removed per side. At the bottom of the grooves, 0.015 inch is removed to produce a diameter of 2.480 to 2.482 in. The tracer also faces the flange so that it is square with the axis of the part within 0.0005 in. Stock removed from this face is 0.005 in.

A 45° angle is finish-machined between the 2.100-in. and 1.928-in. diameters. Stock removal here is 0.010 to 0.015 in. Two O-ring grooves (0.080 to 0.085 in. wide, with a root diameter of 1.807 to 1.810 in.) are then plunge cut from the solid into the 1.928-in. diameter—one on each side of a groove previously rough-machined.

A 30° angle brings the 1.928-in. diameter down to 1.508 in. Here again, stock removal is 0.015 in. Another 30° angle steps the 1.508 in. diameter down to 1.360 in., where another 0.141-in.-wide O-ring groove is produced with a root diameter of 1.180 to 1.182 in. Finally, the end of the sleeve is finish-turned to a diameter of 1.260 in. •



Short runs and precise contours are fast and efficient with this tracer attachment on a standard engine lathe. Valve sleeves in quantities of about 100 pieces are finish turned and grooved with one pass in less time than grinding alone took



1. Typical easily-made jig for directing and containing backup shielding gas when butt welding titanium tube or pipe. Such jigs give two-sided protection essential to welding titanium outside of purged chambers

Welding titanium in the open

Are purge chambers really necessary for welding titanium? Local inert-gas shielding on both sides of the weld can do the job just as well—and there is no limit to the size of parts it can handle

By J A Goodford, chief welding engineer,
and J A Manfre, senior technical services engineer, Crucible Steel Co of America

For a long time it was thought that only small titanium parts could be welded, because the job had to be done in a closed chamber in which air was replaced by an inert gas—and the chambers weren't very big.

Such purged chambers are still popular for welding of small titanium parts, but they aren't absolutely necessary. Now, reliable titanium-to-titanium welds can be made on parts of virtually any size.

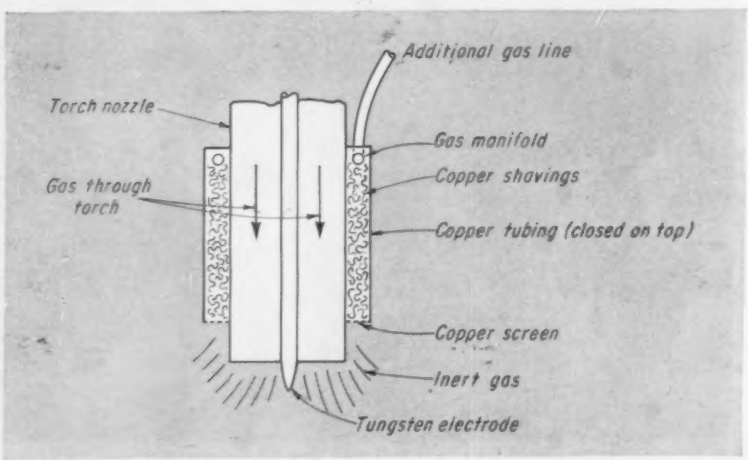
All that's needed is a slight modification of standard stainless steel welding equipment and techniques to bring titanium welding out into the open. Or perhaps "open" isn't quite the word—the job actually requires local inert-gas shielding *on both sides of the weld.*

Needed, too, is extra attention to cleanliness.

This protection, teamed with a little experience and close adherence to established welding techniques, can produce made-in-the-open titanium welds of excellent joint efficency in both alloyed and unalloyed grades (Crucible A-40, A-55, A-70, A-110AT, B-120VCA, and C-120V).

Mechanical properties equal to those of the annealed base metal can be achieved in the as-welded condition in all these grades except C-120AV—and even that alloy can achieve properties approaching those of the base metal if subjected to post-weld heat treatment.

Not only that, corrosion resistance of the shielded welds in all grades (even in as-welded condition) equals that of the base metal.



2. Conventional torch nozzle is modified to bring extra shielding gas to weld area. Copper tubing filled with shavings diffuses gas over joint area in a soft cloud

Effects of contaminants

One of the major drawbacks in welding titanium is that the material is highly reactive and has a great affinity for oxygen, nitrogen, hydrogen, carbonaceous and most other materials. All of these contaminants reduce the ductility of titanium welds, even to the point of making them glass brittle.

Further, titanium's affinity for contaminants is particularly strong at temperatures over 1000 F. The higher the temperature, the more rapidly the gaseous contaminants are absorbed. Therefore, extreme care must be exercised, both in cleaning

the parts before welding and in shielding the weld itself with inert gas.

Joint preparation

All foreign matter, regardless of its nature, must be removed from the area to be welded. If such materials as dirt, metal filings or grindings, abrasives, or paint come in contact with the molten metal, they will be drawn into the metal and, on solidification, may result in inclusions, porosity, or incipient cracks. Because these flaws cannot be removed by remelting the affected weld area, the contaminants must come out before welding.

Wheel grinding and other abrasive methods are often used for initial joint preparation, but these should be followed by draw filing and stainless steel wire brushing. Filing with a fine-tooth file removes the rough surface of the cut edge, which contains numerous crevices.

If not removed, these crevices can serve as pockets or traps for airborne impurities, and can promote formation of gas porosity.

When these steps have been completed, the area should be cleaned either with methanol alcohol or acetone, applied with a cellulose sponge just before welding. Rags, cotton waste, or cloth of any kind should be avoided—they could be a source of contamination.

Also to be avoided are such degreasing solutions as carbon tetrachloride or trichlorethylene, both of which contain halide compounds that could cause titanium to crack at temperatures above 600 F.

Gas shielding

As has been mentioned, an inert gas shield on both sides of the joint is essential to welding titanium in the open. This is true for either Tig (tungsten, inert gas) or Mig (metal, inert gas) welding. With the right shield, either process can be performed manually or automatically.

The shielding gas may be argon, or helium, or a combination of both. Helium causes deeper penetration and faster deposition than argon, but argon tends to produce a flatter, smoother weld.

A combination of the two gases is often used for the prime or face shielding, and straight helium for the backup shielding, thus taking advantage of the good points of both gases. A popular mixture is 65% argon and 35% helium, although this mixture may be varied to suit specific situations.

Pure argon is most popular for

TABLE I — Automatic Tig-welding of Titanium

	Without Filler Metal Addition			With Filler Metal Addition		
Thickness, Inch	0.030	0.060	0.090	0.060	0.090	0.125
Electrode Diameter, Inch	1/16	1/16	1/16-3/32	1/16	1/16-3/32	3/32-⅛
Filler Wire Diameter, Inch	—Not Used—			1/16	1/16	1/16
Wire Feed Rate, ipm	—Not Used—			22	22	20
Volts	10	10	12	10	12	12
Amperes	25-30	90-100	125-160	120-130	160-190	220-230
Nozzle ID, Inch	¾	¾	¾	⅝	¾	¾
Gas Flow Rate, cfh						
Primary Shield	15A	15A	20A	15A	20A	20A
Trailing Shield	15A	20A	25A	20A	25A	30A
Backup Shield	3He	3He	4He	4He	4He	5He
Backup Groove, Inch	¼x.015	¼x.060	⅜x1/16	¼x.050	⅜x1/16	⅜x1/16
Welding Speed, ipm	10-20	10-20	10-20	10-20	12-20	12-25
Power Supply	(Direct Current Straight Polarity)					

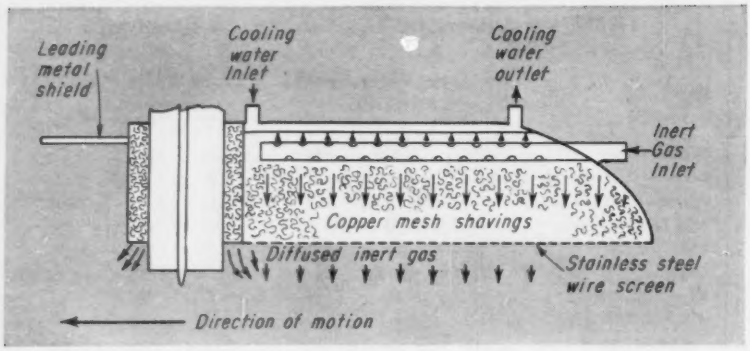
TABLE II — Manual Tig-welding of Titanium

Material Thickness, (Inch)	Current* (Amperes)	Potential (Volts)	Electrode Point Geometry	Argon Gas Flow (cfh) Torch	Trailing Shield	Backup
0.050	60-70	9	20° Angle	10	10	3
0.070	85-95	9	90° Angle	15	15	4
0.080	120-130	9	90° Angle	15	15	5
0.140 first pass	130-140	9	Flat	20	15	6
second pass	105-115	9	Flat	20	15	6

* Direct current, straight polarity

TABLE III — Automatic Mig-welding of Titanium

Material Thickness, Inch	0.125	0.250	0.500	0.625
Wire Diameter, Inch	1/16	1/16	1/16	1/16
Wire Feed Rate, ipm	200-225	300-320	375-400	400-425
Volts	20	30	40	45
Amperes	250-260	300-320	340-360	350-370
Nozzle ID, Inch	¾-1	¾-1	¾-1	¾-1
Gas Flow Rate, cfh				
Primary Shield	50A + 15He	50A + 15He	50A + 15He	50A + 15He
Trailing Shield	30A	35A	40A	40A
Backup Shield	20He	25He	30He	30He
Backup Material	Cu	Cu	Cu	Cu
Backup Groove	⅜x1/16 or 3/16x1/16	½x3/32 or ¼x1/16	⅝x3/32 or ¼x1/16	⅝x3/32 or ¼x1/16
Weld Speed, ipm	15-25	15-25	15-30	15-35
Power Supply	(Direct Current Reverse Polarity)			



3. Trailing gas shield added to modified Mig torch nozzle is recommended for fast machine welding. Leading shield keeps spatter out of unwelded joint area

prime shielding in manual welding, and helium for the backup shielding. Here again, however, the prime shielding may be a combination of both gases (more argon than helium).

The generally recommended settings for shielding gas and welding current are shown in Tables I, II, and III. There is no table for manual Mig welding because Tig is usually preferred for the thinner gages. (Mig has an advantage only in heavier work requiring filler-metal additions and machine operation).

The tables are intended as a basic guide only, because the gas pressure and current settings may vary with the type of equipment employed. They may also vary because of joint geometry. In general, the best welds are obtained by welding at the highest reasonable speed as the weld is less likely to become contaminated.

Tooling for gas backup

Flat butt joints in thin material (up to 0.045 in.) can be backed up with a flat copper bar. However, the bar must be held in intimate contact with the titanium throughout the length of the joint to exclude air from the root side of the weld.

For heavier-gage material, a grooved bar should be used. The groove may vary from ¼ to ⅜ in. wide and from 0.010 to 0.060 in. deep, depending on the thickness of the titanium being welded. This groove is purged with the backup gas before welding, and gas flows through it during the entire operation.

For containers or pipe, the container itself is sealed and purged with inert gas and a small bleeder hole is provided at one end for full evacuation and purging.

A portable jig for shielding the immediate joint area when welding pipe is shown in Fig. 1. A fireproof, flexible gasket conforms to the ID of the pipe and creates a dam on each side of the joint. With correct gas pressure, and with the outlet holes properly placed, the gas will flow smoothly and uniformly to the open seam.

Because titanium needs better shielding than most other metals, the torch nozzle cup should be larger than usual. A conventional torch can be modified as shown in Fig. 2. Here, copper shavings act as a diffuser so that the inert gas flows down over the weld in a soft diffused cloud. To further protect the molten weld pool, the welding arc should be shorter for titanium than for other metals. In other words, the nozzle should be as close to the work as is possible without obstructing the operator's view of the weld pool.

For manual welding, the device shown in Fig. 2 generally gives better results than a trailing gas shield does, and it's easier to handle. For machine automatic welding, both the modified torch cup and a long trailing shield are recommended (See Fig. 3).

For Mig welding, a flat metal shield attached to the leading side of the torch is also advisable. Otherwise, spatter can leave the protective gas atmosphere, oxidize, and drop on the joint line to cause weld contamination and porosity.

It is also helpful sometimes to create a dam on each side of the weld line. This contains the gas more efficiently and therefore adds up to more effective shielding and lower gas consumption.

Work area

Arc welding should be done away from open windows and doors because air currents from such openings disturb the inert gas shielding and expose the molten weld metal to contamination. The operation should also be remote from other shop activities that could cause airborne contamination—grinding, polishing, sand blasting, painting.

For the ultimate in weld quality, it is highly desirable to perform the work in a separate room. The room should be air conditioned and dehumidified—for quality work as well as for the operator's comfort—because moisture on titanium causes hydrogen pickup, resulting in poor welds. Air from the ventilating system should be diffused so it doesn't cause any direct air blasts.

When titanium is welded in a clean, adequately equipped work area, and when recommended procedures are carefully followed, it is possible to produce top quality titanium weldments, closely approximating the best welding done in a purged chamber.

Inspection and testing

Inspection procedures for titanium weldments are similar to those employed for other metals. Such nondestructive techniques as visual examination, dye-penetrant inspection, and radiographic inspection all play their usual roles in determining weld quality. In addition, hardness surveys, mechanical property tests, and metallographic examination are made on representative weld samples.

Destructive testing, of course, is a sure way to determine weld quality. For one such technique, a weld coupon is cut out of the work and subjected to a vise bend test. Another simple method is draw filing. If the weld is poor, it is hard and is thus difficult to file; a good weld is soft and easy to file.

Hardness is another important clue. Unless contamination has occurred, there is no metallurgical reason for the weld area to be harder than the parent metal. An increase of 30 points on the Brinell scale or 6 points on the Rockwell scale (B or C) indicates contamination at a level that would lower ductility and toughness of the weld.

However, this test should be used with some discretion, because orientation of large grains (along with some other factors not well understood) causes considerable scatter in hardness testing of titanium. For this reason, at least 4 or 5 hardness checks should be made on both the weld and the parent metal. •

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Let us give you some other important facts about these new starters, which include reversing starters, multi-speed starters, combination starters, etc. Please write for Publication 6100: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.

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*Compared with old Allen-Bradley starters

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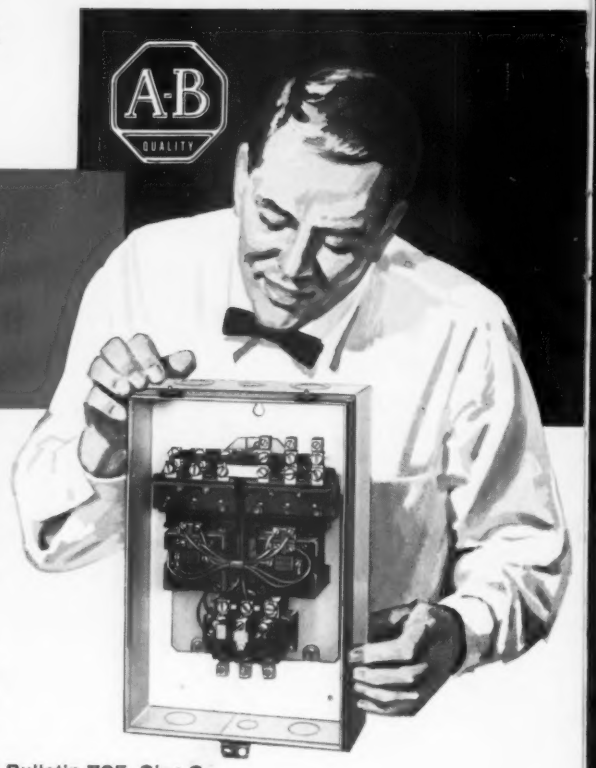

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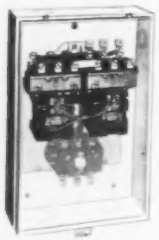
In the enclosed reversing switch, a two-unit or three-unit block-type overload relay is mounted below the contactors. The mechanical interlocks are new and so simple in design, they just can't fail to give you dependable service. For more details please write to: Allen-Bradley Co., 1316 South Second Street Milwaukee 4, Wisconsin.

Bulletin 705 Size 2
reversing starter in Nema Type 1 enclosure.
Ratings to 100 hp, 220 v; 200 hp, 440-550 v.



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Though greatly reduced in size, each rating of this new line of reversing switches has a tremendous reverse switching capacity. The new and patented high efficiency magnet is cushioned to reduce shock and wear. The new molded coil is impervious to the most corrosive atmospheres. The new precision hot molded arc hood greatly increases the interrupting capacity and confines the arc. The new weld-resistant cadmium oxide silver contacts seat square—no more sliding motion that causes wear.

NEW, POSITIVE MECHANICAL INTERLOCK

The simplicity and ruggedness of the new cam-type interlocks assure continuous reliability—they're good for the life of the reversing starter. The interlock does not have to be disturbed or adjusted after changing either contacts or coil. It is located between the contactors—out of the way—where careless wiring cannot interfere with the positive and consistent operation of the interlock.

NEW, BLOCK-TYPE OVERLOAD RELAYS

The new A-B trip-free and tamperproof overload relays—either hand or automatic reset—have also been completely redesigned. But the time-proven "solder ratchet" principle, which assures permanent accuracy and reliability regardless of atmospheric conditions—has been retained. The block-type relays are furnished as either two unit or three unit, both having identical mounting dimensions. When used on special control panels, this new design eliminates the need for a separate terminal block. An indicating device is provided on each relay to show when it has been tripped.

18-61-RM

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QUALITY MOTOR CONTROL

Hardness Conversion Tables—I

The new American Standard Z 76.4—1961 embodies the collection of standard hardness conversion tables found in Standard E 140—58 issued by the American Society for Testing and Materials, 1916 Race St, Philadelphia 3, Pa. Through the courtesy of ASTM, two tables from E140-58 are reprinted here. The complete standard can be obtained from ASTM.

Both tables present data on the relationships of Brinell hardness, diamond pyramid hardness, Rockwell hardness and Rockwell Superficial hardness for carbon, alloy and tool steels in the as-forged, annealed, normallized and quenched and tempered conditions, provided these materials are homogeneous. The table on this page correlates hardness numbers in relation to the Rockwell C reading, whereas the table on page 123 presents similar data in relation to the Brinell indentation diameter.

Rockwell C Hardness Number	Diamond Pyramid Hardness Number	Brinell Hardness Number*			Rockwell Hardness Number		Rockwell Superficial Hardness Number			Rockwell C Hardness Number
		10-mm Standard Ball, 3000-kg Load	10-mm Hultgren Ball, 3000-kg Load	10-mm Carbide Ball, 3000-kg Load	A Scale, 60-kg Load, Diamond Cone Penetrator	D Scale, 100-kg Load, Diamond Cone Penetrator	15-N Scale, 15-kg Load, Superficial Diamond Cone Penetrator	30-N Scale, 30-kg Load Superficial Diamond Cone Penetrator	45-N Scale, 45-kg Load Superficial Diamond Cone Penetrator	
68	940	..	..	..	85.6	76.9	93.2	84.4	75.4	68
67	900	..	..	..	85.0	76.1	92.9	83.6	74.2	67
66	865	..	..	..	84.5	75.4	92.5	82.8	73.3	66
65	832	..	..	**739**	83.9	74.5	92.2	81.9	72.0	65
64	800	..	..	**722**	83.4	73.8	91.8	81.1	71.0	64
63	772	..	..	**705**	82.8	73.0	91.4	80.1	69.9	63
62	746	..	..	**688**	82.3	72.2	91.1	79.3	68.8	62
61	720	..	..	**670**	81.8	71.5	90.7	78.4	67.7	61
60	697	..	**613**	**654**	81.2	70.7	90.2	77.5	66.6	60
59	674	..	**599**	**634**	80.7	69.9	89.8	76.6	65.5	59
58	653	..	**587**	615	80.1	69.2	89.3	75.7	64.3	58
57	633	..	**575**	595	79.6	68.5	88.9	74.8	63.2	57
56	613	..	**561**	577	79.0	67.7	88.3	73.9	62.0	56
55	595	..	**546**	560	78.5	66.9	87.9	73.0	60.9	55
54	577	..	**534**	543	78.0	66.1	87.4	72.0	59.8	54
53	560	..	**519**	525	77.4	65.4	86.9	71.2	58.6	53
52	544	**500**	**508**	512	76.8	64.6	86.4	70.2	57.4	52
51	528	487	494	496	76.3	63.8	85.9	69.4	56.1	51
50	513	475	481	481	75.9	63.1	85.5	68.5	55.0	50
49	498	**464**	469	469	75.2	62.1	85.0	67.6	53.8	49
48	484	451	455	455	74.7	61.4	84.5	66.7	52.5	48
47	471	442	443	443	74.1	60.8	83.9	65.8	51.4	47
46	458	432	432	432	73.6	60.0	83.5	64.8	50.3	46
45	446	421	421	421	73.1	59.2	83.0	64.0	49.0	45
44	434	409	409	409	72.5	58.5	82.5	63.1	47.8	44
43	422	400	400	400	72.0	57.7	82.0	62.2	46.7	43
42	412	390	390	390	71.5	56.9	81.5	61.3	45.5	42
41	402	381	381	381	70.9	56.2	80.9	60.4	44.3	41
40	392	371	371	371	70.4	55.4	80.4	59.5	43.1	40
39	382	362	362	362	69.9	54.6	79.9	58.6	41.9	39
38	372	353	353	353	69.4	53.8	79.4	57.7	40.8	38
37	363	344	344	344	68.9	53.1	78.8	56.8	39.6	37
36	354	336	336	336	68.4	52.3	78.3	55.9	38.4	36
35	345	327	327	327	67.9	51.5	77.7	55.0	37.2	35
34	336	319	319	319	67.4	50.8	77.2	54.2	36.1	34
33	327	311	311	311	66.8	50.0	76.6	53.3	34.9	33
32	318	301	301	301	66.3	49.2	76.1	52.1	33.7	32
31	310	294	294	294	65.8	48.4	75.6	51.3	32.5	31
30	302	286	286	286	65.3	47.7	75.0	50.4	31.3	30
29	294	279	279	279	64.7	47.0	74.5	49.5	30.1	29
28	286	271	271	271	64.3	46.1	73.9	48.6	28.9	28
27	279	264	264	264	63.8	45.2	73.3	47.7	27.8	27
26	272	258	258	258	63.3	44.6	72.8	46.8	26.7	26
25	266	253	253	253	62.8	43.8	72.2	45.9	25.5	25
24	260	247	247	247	62.4	43.1	71.6	45.0	24.3	24
23	254	243	243	243	62.0	42.1	71.0	44.0	23.1	23
22	248	237	237	237	61.5	41.6	70.5	43.2	22.0	22
21	243	231	231	231	61.0	40.9	69.9	42.3	20.7	21
20	238	226	226	226	60.5	40.1	69.4	41.5	19.6	20

* The Brinell hardness numbers in boldface type are outside the range recommended for Brinell hardness testing in Section 5(c) of the Method of Test for Brinell Hardness of Metallic Materials (ASTM Designation: E 10), see 1958 Book of ASTM Standards, Part 3.

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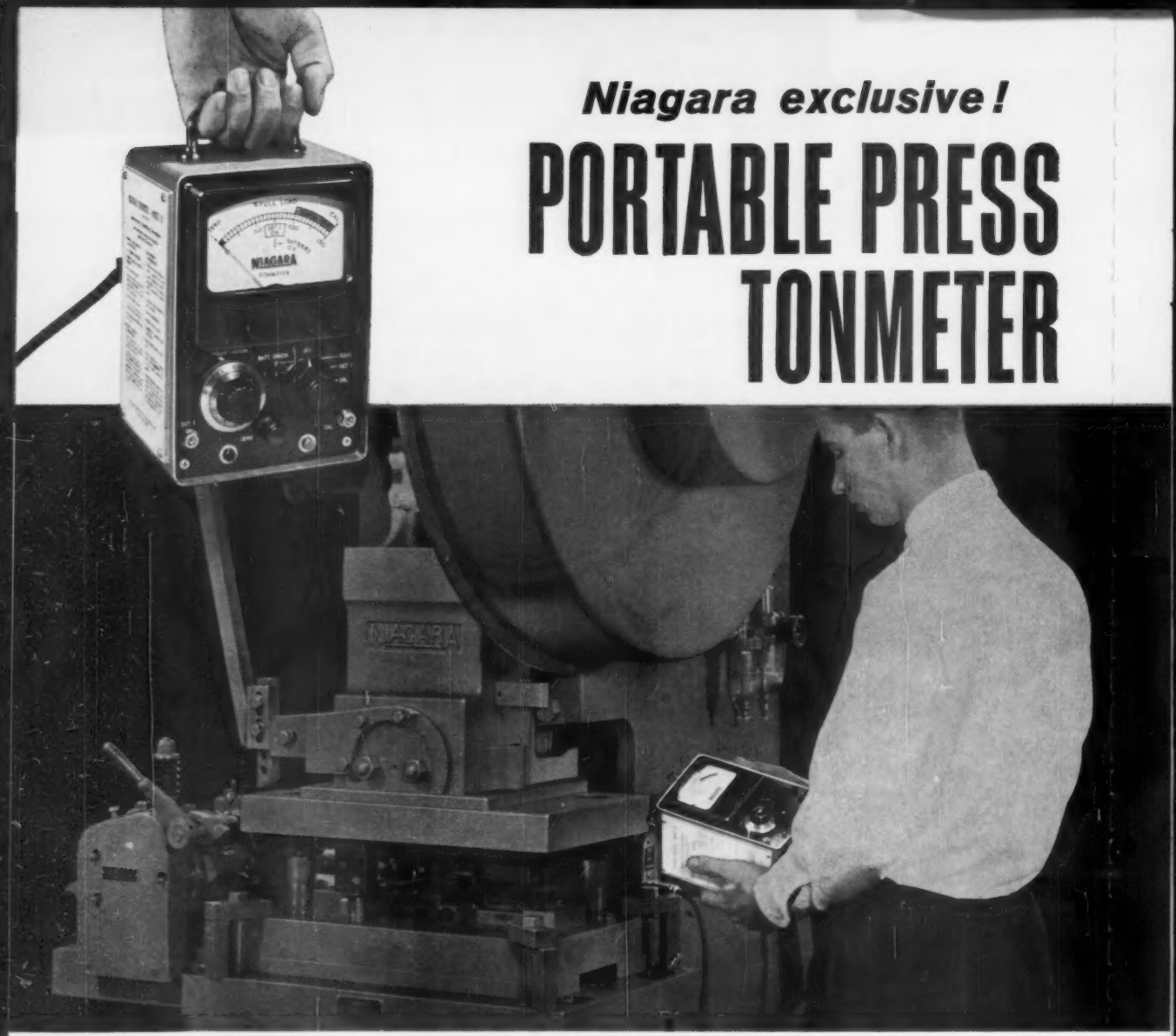

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Hardness Conversion Tables—II

Brinell Indentation Diameter, mm	Brinell Hardness Number*			Diamond Pyramid Hardness Number	Rockwell Hardness Number			Rockwell Superfical Hardness Number			Brinell Indentation Diameter, mm
	10-mm Standard Ball, 3000-kg Load	10-mm Hultgren Ball, 3000-kg Load[a]	10-mm Carbide Ball, 3000-kg Load		C Scale, 150-kg Load, Diamond Cone Penetrator	A Scale, 60-kg Load, Diamond Cone Penetrator	D Scale, 100-kg Load, Diamond Cone Penetrator	15-N Scale, 15-kg Load, Superficial Diamond Cone Penetrator	30-N Scale, 30-kg Load, Superficial Diamond Cone Penetrator	45-N Scale, 45-kg Load Superficial Diamond Cone Penetrator	
2.35	..	..	**682**	737	61.7	82.2	72.0	91.0	79.0	68.5	2.35
2.40	..	..	**653**	697	60.0	81.2	70.7	90.2	77.5	66.5	2.40
2.45	..	..	627	667	58.7	80.5	69.7	89.6	76.3	65.1	2.45
2.50	..	..	..	..	..	..	..	..	..	..	2.50
	..	**601**	..	677	59.1	80.7	70.0	89.8	76.8	65.7	
	..	..	601	640	57.3	79.8	68.7	89.0	75.1	63.5	
2.55	..	..	..	..	..	..	..	..	..	..	2.55
	..	**578**	..	640	57.3	79.8	68.7	89.0	75.1	63.5	
	..	..	578	615	56.0	79.1	67.7	88.4	73.9	62.1	
2.60	..	..	..	..	..	..	..	..	..	..	2.60
	..	**555**	..	607	55.6	78.8	67.4	88.1	73.5	61.6	
	..	..	555	591	54.7	78.4	66.7	87.8	72.7	60.6	
2.65	..	..	..	..	..	..	..	..	..	..	2.65
	..	**534**	..	579	54.0	78.0	66.1	87.5	72.0	59.8	
	..	..	534	569	53.5	77.8	65.8	87.2	71.6	59.2	
2.70	..	..	..	..	..	..	..	..	..	..	2.70
	..	**514**	..	553	52.5	77.1	65.0	86.7	70.7	58.0	
	..	..	514	547	52.1	76.9	64.7	86.5	70.3	57.6	
2.75	**495**	..	..	539	51.6	76.7	64.3	86.3	69.9	56.9	2.75
	..	495	..	530	51.1	76.4	63.9	86.0	69.5	56.2	
	..	..	495	528	51.0	76.3	63.8	85.9	69.4	56.1	
2.80	**477**	..	..	516	50.3	75.9	63.2	85.6	68.7	55.2	2.80
	..	477	..	508	49.6	75.6	62.7	85.3	68.2	54.5	
	..	..	477	508	49.6	75.6	62.7	85.3	68.2	54.5	
2.85	**461**	..	..	495	48.8	75.1	61.9	84.9	67.4	53.5	2.85
	..	461	..	491	48.5	74.9	61.7	84.7	67.2	53.2	
	..	..	461	491	48.5	74.9	61.7	84.7	67.2	53.2	
2.90	**444**	..	..	474	47.2	74.3	61.0	84.1	66.0	51.7	2.90
	..	**444**	..	472	47.1	74.2	60.8	84.0	65.8	51.5	
	..	..	**444**	472	47.1	74.2	60.8	84.0	65.8	51.5	
2.95	429	429	429	455	45.7	73.4	59.7	83.4	64.6	49.9	2.95
3.00	415	415	415	440	44.5	72.8	58.8	82.8	63.5	48.4	3.00
3.05	401	401	401	425	43.1	72.0	57.8	82.0	62.3	46.9	3.05
3.10	388	388	388	410	41.8	71.4	56.8	81.4	61.1	45.3	3.10
3.15	375	375	375	396	40.4	70.6	55.7	80.6	59.9	43.6	3.15
3.20	363	363	363	383	39.1	70.0	54.6	80.0	58.7	42.0	3.20
3.25	352	352	352	372	37.9	69.3	53.8	79.3	57.6	40.5	3.25
3.30	341	341	341	360	36.6	68.7	52.8	78.6	56.4	39.1	3.30
3.35	331	331	331	350	35.5	68.1	51.9	78.0	55.4	37.8	3.35
3.40	321	321	321	339	34.3	67.5	51.0	77.3	54.3	36.4	3.40
3.45	311	311	311	328	33.1	66.9	50.0	76.7	53.3	34.4	3.45
3.50	302	302	302	319	32.1	66.3	49.3	76.1	52.2	33.8	3.50
3.55	293	293	293	309	30.9	65.7	48.3	75.5	51.2	32.4	3.55
3.60	285	285	285	301	29.9	65.3	47.6	75.0	50.3	31.2	3.60
3.65	277	277	277	292	28.8	64.6	46.7	74.4	49.3	29.9	3.65
3.70	269	269	269	284	27.6	64.1	45.9	73.7	48.3	28.5	3.70
3.75	262	262	262	276	26.6	63.6	45.0	73.1	47.3	27.3	3.75
3.80	255	255	255	269	25.4	63.0	44.2	72.5	46.2	26.0	3.80
3.85	248	248	248	261	24.2	62.5	43.2	71.7	45.1	24.5	3.85
3.90	241	241	241	253	22.8	61.8	42.0	70.9	43.9	22.8	3.90
3.95	235	235	235	247	21.7	61.4	41.4	70.3	42.9	21.5	3.95
4.00	229	229	229	241	20.5	60.8	40.5	69.7	41.9	20.1	4.00

* The Brinell hardness numbers in boldface type are outside the range recommended for Brinell hardness testing in Section 5(*c*) of the Method of Test for Brinell Hardness of Metallic Materials (ASTM Designation: E 10), see 1958 Book of ASTM Standards, Part 3.

[a] Brinell hardness values are given for the Hultgren ball to 601 Brinell hardness; however, flattening of the ball at the higher hardnesses gives lower Brinell hardness values than obtained with the carbide ball. For example, material having a DPH value of 667 has a carbide ball Brinell hardness of 627, while material having a DPH value of 677 has a Hultgren ball Brinell hardness of only 601.

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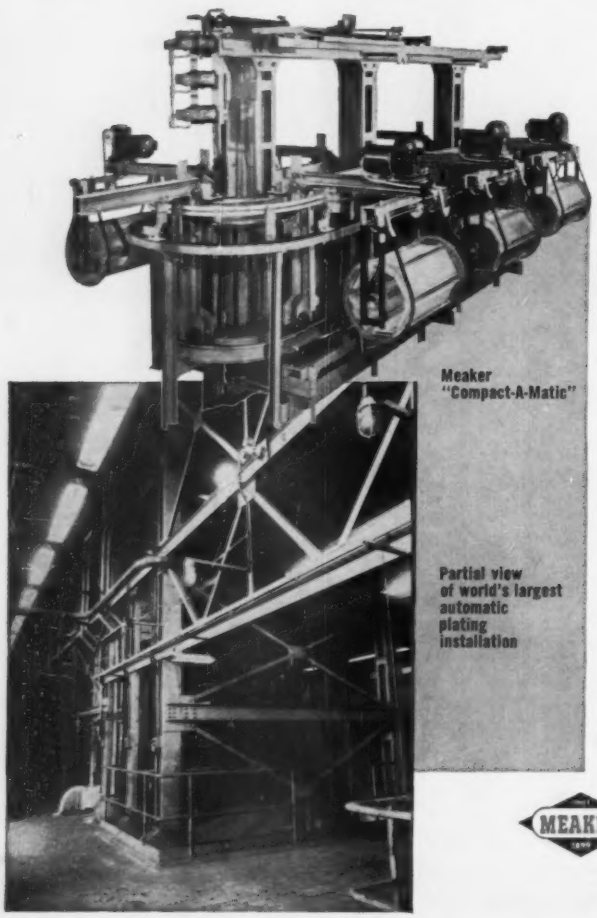

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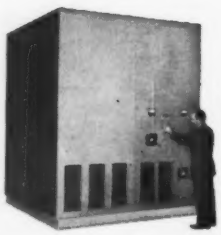

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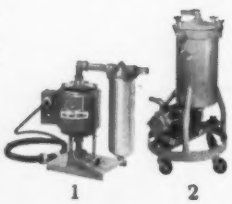

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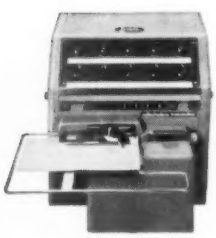
How Convair-Astronautics keeps track of this...

(and 84,999 other missile parts)



The Manufacturing Control Department at Convair (Astronautics) Division of General Dynamics Corporation has a monumental problem: how to keep track of the movement of over 85,000 individual missile parts.

The solution: *automated data preparation* by means of a Friden Collectadata® system. Situated in key plant locations, Collectadata transmitters report virtually all parts movements—over 5000 every day—to central Collectadata receivers which record them into punched paper tape. At day's end the Collectadata tapes are fed into the electronic computer at Astronautics for further data processing.

This is what Astronautics says: *"The Collectadata has been in use at Astronautics for less than a year. But by eliminating tedious manual paperwork, and by assuring prompt processing of all inventory reports, it has already saved considerable time, trouble and money."*

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End Your Tool Steel Problems with the A-L STEELECTOR System

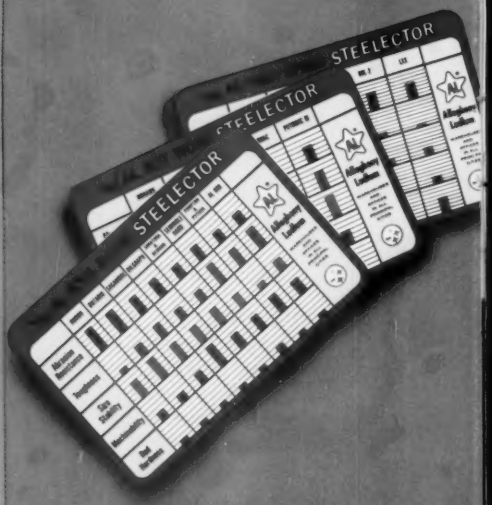
STEELECTOR

Save Selection Time, Insure Accuracy, Cut Inventory Costs

If you started using the new Allegheny Ludlum STEELECTOR Program first introduced last year, you know what savings it can bring. If you didn't, your competitors may have stolen a march on you.

There are many advantages in the STEELECTOR system. Perhaps most important is the savings in selection time. No longer need anyone spend hours in tool steel selection. By using one of the STEELECTOR Cards, an accurate selection can be made virtually at a glance. In seconds you can choose the tool steel grade with the particular combination of red hardness, abrasion resistance, size stability, toughness, and machinability required by the job at hand.

You can select STEELECTOR tool steels with confidence—they are always in stock. You don't have to stockpile tool steel. Instead, by relying on Allegheny Ludlum material and using STEELECTOR grades, you can reduce the variety of tool steels in your inventory. You reduce problems because the STEELECTOR offers the tool steels that are right for your jobs, eliminates those that contribute nothing but confusion.



STEELECTOR Cards Save Selection Time

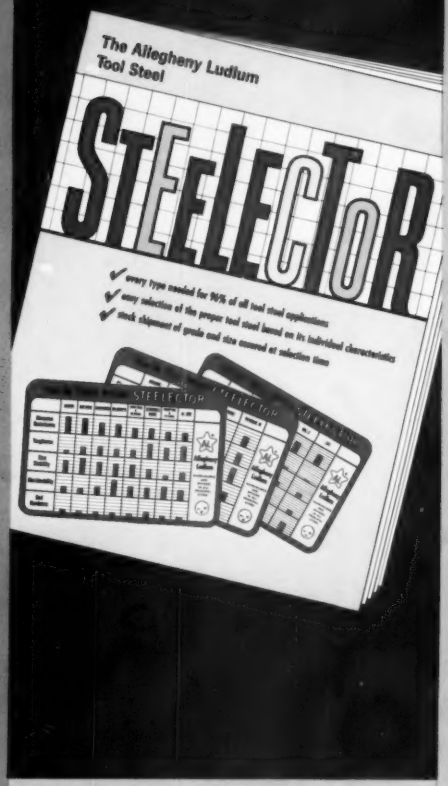
The three STEELECTOR Cards insure that you will pick the right tool steel for every application. Each STEELECTOR Card (there are cards for tool room, hot work, and high speed applications) uses bar graphs to indicate the relative abrasion resistance, toughness, size stability, machinability, and red hardness of the STEELECTOR grades. You can select the best combination of properties for the job at hand virtually at a glance.

STEELECTOR tool steels will meet your job requirements. You can clean house with the STEELECTOR Program. No longer need your stockroom be cluttered with small stocks of scores of grades. No longer need you find yourself holding grades that require different processing, yet give the same results. And you never need to worry about running short. Allegheny Ludlum STEELECTOR grades are always in stock.

STEELECTOR Program Ends Supply Problems

Huge warehouse stocks back up Allegheny Ludlum's STEELECTOR Program. You know before you order that the grade you have selected is in stock, in the size you choose. Here's how the STEELECTOR System works:

First, you select the right tool steel for your job by using a STEELECTOR Card. Then you check the STEELECTOR Data Stock List for the particular grade selected best for your job. (There is a List for each of the 18 STEELECTOR grades.) All sizes and shapes in stock are listed along with hardening, tempering, and annealing temperatures. The List also gives the typical analysis of the steel, its AISI number, and describes its properties. Typical applications are listed along with suggested working hardnesses to confirm your selection.



Free Booklet Explains the STEELECTOR System

You will find a complete description of the STEELECTOR Program in this colorful 10-page Allegheny Ludlum booklet. It tells how the STEELECTOR System helps you pick the right tool steels, save time, and end your supply worries.

Each of the STEELECTOR grades is listed in the booklet along with its description, applications, and AISI type number. Included are three handy STEELECTOR Cards that will save you time in picking the right steel for tool room, hot work, and high speed applications. Everyone who helps select tool steel needs this booklet. For your free copy ask your A-L representative, or write: Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. TS12.

What Can The A-L STEELECTOR Program Do For You?

Whether you are president, purchasing agent, stock room supervisor, engineer, or heat treater, you will find the STEELECTOR System can save you time, reduce costs, and make your job easier. Check this list and see how the STEELECTOR System can help you:

Owner, president or vice president. Reduces costs in warehousing, purchasing, and inventorying. Insures selection of the right tool steel—prevents misapplication and wrong heat treatment.

Operating man, superintendent, foreman, production control man. Ends availability problems. Large local warehouse stocks enable your in-plant stocks to be reduced. Consistent high quality.

Engineer or metallurgist. Speeds selection of the right tool steel . . . saves the time formerly spent in selection for jobs that need it.

Specifier, designers, tool room man. Assures you of the availability of the size and grade you need. Only 18 grades to consider for 96 percent of all applications.

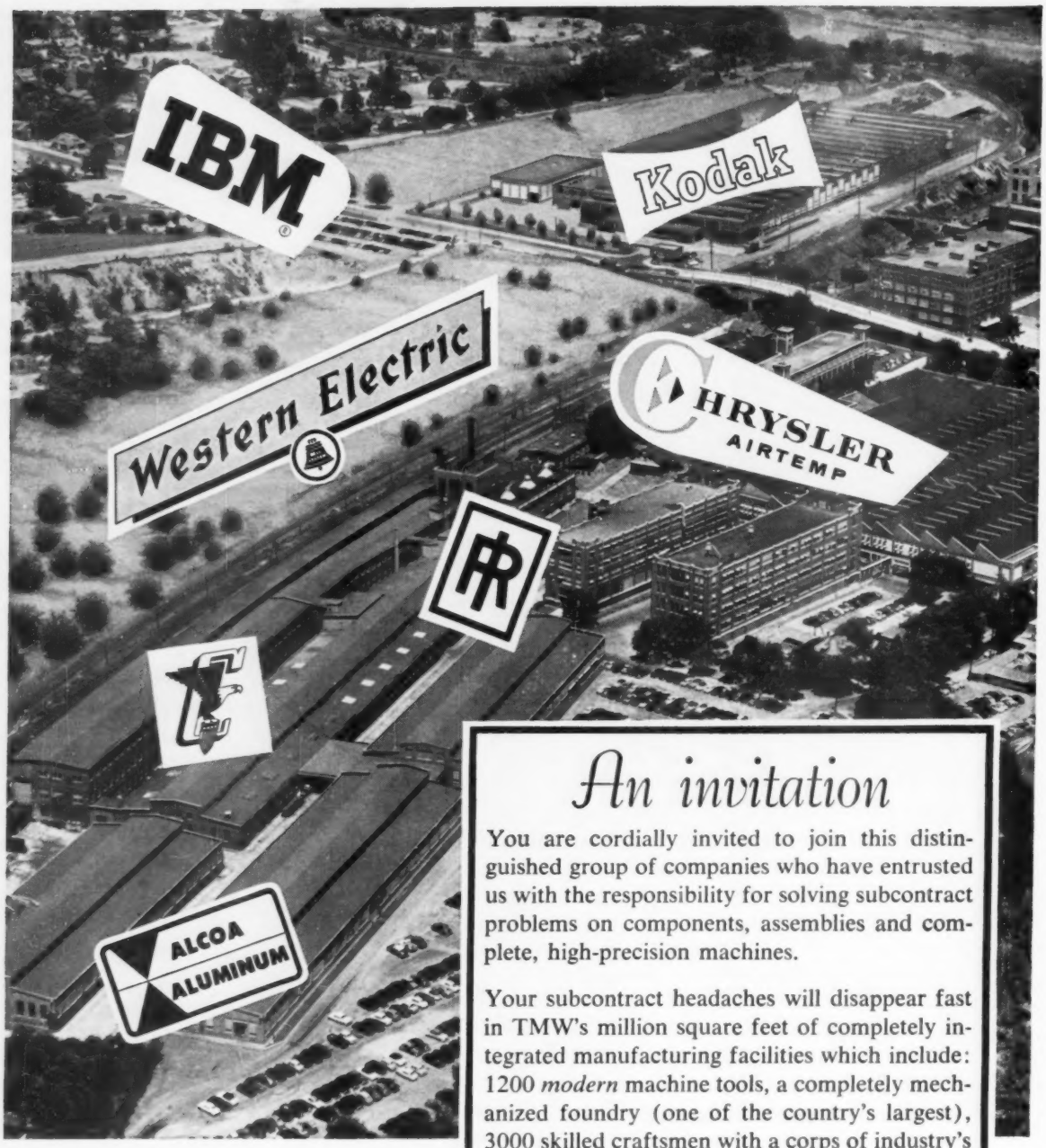
Stock room supervisor. Saves storage space because fewer grades need to be stocked. Ordering is simplified and paperwork reduced.

Heat treater. Helps you operate furnaces more profitably —more tools can be treated at a time.

Purchasing agent. Reduces paperwork and inventory needs.

To learn of all the benefits of the A-L STEELECTOR System, ask for the STEELECTOR booklet described in the adjoining column. 3107

ALLEGHENY LUDLUM AL®



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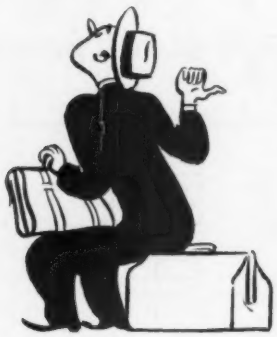
Talking Shop



Travel Problem

WITH INTEREST GROWING in the development of international standards, it is becoming increasingly important that U S industry take an active role in the development of such standards if it wants the U S point of view presented forcefully in the formulating stages.

Too often, the drafting of an international standard is left to a working committee whose meetings we can't afford to attend and when the plenary stage is reached we expect one or two overworked delegates to present the U S attitude on a score or more of highly technical areas of as many different fields. At one minute the delegate will be talking about the direction of rotation of controls on machine tools and the next he will be discussing test methods for electric motors. Even the best men are at a disadvantage under such conditions.

If we are serious about our foreign trade we had better be serious about the developing area of international codes and standards that may one day determine what we can and can't sell abroad.

The big hurdle is the transatlantic air fare. A company will place one of its technical staff on a committee that meets two or three times a year in the U S without hesitation, but is understandably hesistant about even annual meetings abroad.

Perhaps the solution is a fund to cover the travel cost of U S members of committees rather than doing each one on a hat-in-hand basis as now. We'd like to see a study made of the possibilities of the American Standards Association becoming custodian of such a fund with industry contributing in proportion to its interest in foreign trade.

Who Measures Productivity?

EVERYBODY TALKS about productivity in broad, national terms, but not many companies measure it in specific terms for their own plant. We reported on one that does when we told about IBM's method (AM—Feb 20, '61, p105). Now the National Industrial Conference Board has reported on five companies that use productivity to:

- Plan and control manufacturing operations.
- Measure the effectiveness of investments in machinery.
- Determine the effect of a given wage increase.
- Understand the relationship of wages, prices, and productivity.

The report is in NICB's "Measuring Company Productivity."

Honed Shaft

ROTOR SHAFTS for ships produced at US Steel's Homestead plant used to be reamed and lapped on the inside diameter. A typical bore might be 4.5-in. diameter and 27 ft long. A satisfactory bore by reaming and lapping might take 80 hours.

Now the job is done in one hour by honing. A Micromatic Hydrahoner is used to both rough and finish hone the bores. Finish honing is accomplished during the last three minutes of the cutting cycle by reducing the expansion of the abrasive stones to provide a fine feed. About 0.025 in. of stock is removed altogether.

Fuel on the Flame

"IS CREATIVE DESIGN being shackled by production inertia?" was the provocative title of a paper presented at the SAE Heavy Duty Vehicle Meeting last fall. Turner Timberlake of the Army Engineer R & D Labs answered his own question with a strong yes. Timberlake was reporting on a study that the Ft Belvoir lab had made of 98 different product redesigns for devolopments on earthmoving equipment.

These projects were traced from beginning to end and what shocked the author was that he discovered that the equipment lovingly developed by the designers was being redesigned by the manufacturing men.

It was found that about 78% of the design changes related directly to some aspect of the manufacturing process. In tractors, the design changes averaged 3.5 per individual part when the tractor was a new design to the manufacturer, but similar to ones already produced by other manufacturers. Design changes averaged 4.3 per part when the tractor was a new concept.

We agree with some of Timberlake's conclusions: "Technical advances occur at a pace much more rapid than tooling wears out or can be depreciated by the present tax structure to stimulate investment in new machinery." We'll even agree that not all production men are as up-to-date on new methods as they should be.

But we think he underrates the contribution they made, when his own figures show that more than three out of every four design changes were to make the product less costly to manufacture. •

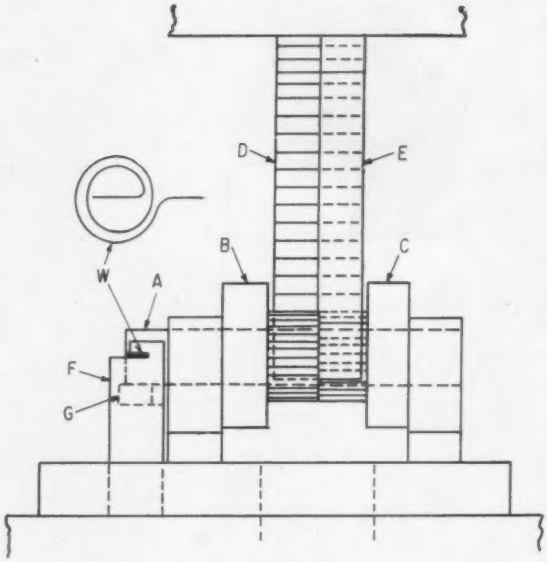
Practical Ideas

Die Forms Spiral Springs

This special die was designed to wind a flat-wire spiral spring having two full turns with one stroke of a short-stroke press. To achieve this it was necessary to utilize both the downstroke and the upstroke.

The mandrel *A* has a slot cut across one end to receive the end of the precut length of half-hard spring steel. Mounted on it are two one-way roller clutches *B* and *C*, each carrying a pinion on its hub. Attached to the ram are two rack sections *D* and *E* so arranged that section *D* meshes with the pinion *B* on the side away from the operator, and section *E* meshes with pinion *C* on the side nearer the operator. The gear ratio is such that one stroke, down or up, produces one full revolution of the mandrel. A hole in the die plate permits the racks to pass through on the downstroke. The block *F* is slotted to guide the strip and prevent it from curling up during the forming operation, and the spring plunger *G* applies pressure to the strip to hold it tightly against the mandrel during forming.

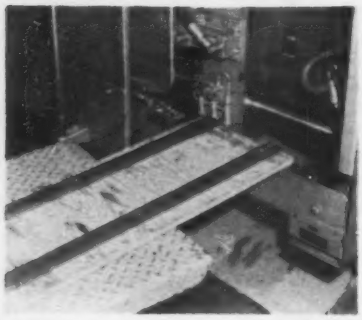
The straight blank is inserted in the slot in guide *F* and in the slot in the end of the mandrel, its outer end being positioned against a stop, not shown. As the ram descends, clutch *C* is operated by rack *E*, rotating it in a clockwise direction, as seen from the left. Rack *D* also rotates clutch *B*, but this is free-wheeling and so transmits no motion to the mandrel. On the upstroke, clutch *B* rotates the mandrel in the same direction while clutch *C* free-wheels.



A forked hand tool is used to strip the work off the mandrel, and natural springback allows it to open up to the shape shown.

L Kasper, Philadelphia, Pa

Slide Aids Mold Positioning



Whenever a mold has to be put into a horizontal molding machine, the operator usually slides it into the machine along any piece of material that happens to be handy, resting the support on the tierods. If he uses a steel slide, the rods may be nicked or scored by it. If he uses a wood, he finds it hard to slide the mold along it.

We found it to be a big help to keep a "sliding board" near the machines. It is made of a piece of half-inch plywood to which are screwed two steel rails. The screw heads are countersunk well below the surface of the steel. In this way we combine the good sliding characteristics of the steel with the protection of the tierods by the wood.

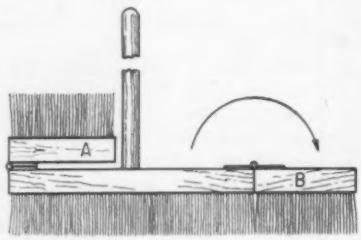
Howard Levy, Brooklyn, NY

Folding Wings Improve Broom

When sweeping up in the shop you can do a faster job with a wide broom, but you run into trouble when trying to use it in narrow aisles and between machines. With the design shown here, you can adjust the width by raising or lowering one or both wings.

To make it, use two similar push brooms, remove the handle from one and cut the body of the broom into pieces, each about ½ in. shorter than the half length. Attach the two sections to the ends of the other broom by means of strap hinges and screws.

Fred Lettino, L I City, NY

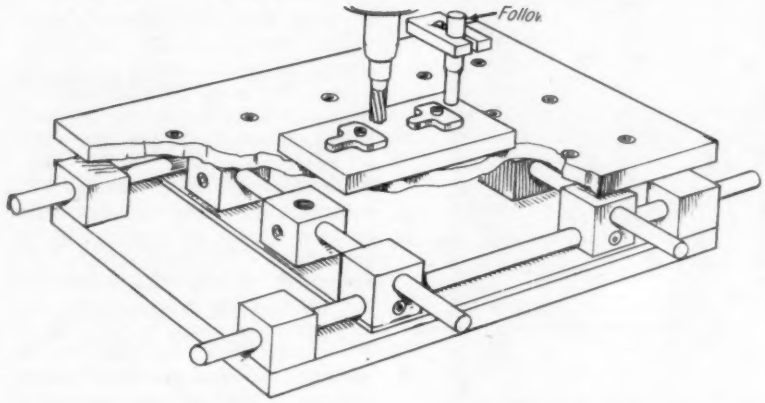


Wrench Serves as Pipe Vise

When you've just got to have a pipe vise and there isn't one handy, you can do an emergency job with a monkey wrench and an ordinary bench vise. Open the wrench jaws so the edges of both jaws will bear on the OD of the pipe, then put both the wrench and the pipe into the bench vise and tighten up. This will give a three-point grip and will hold the pipe without slipping.

H Burdett, Tacoma, Wash

Floating Table Permits Profile Milling



We had to mill a lot of small brass details of irregular contour and could not tie up our engraving machine for so long a time. So we built a floating table for use on a vertical mill and made it big enough to handle a fairly wide range of part sizes.

The base is a piece of half-inch ground stock, 6 x 10 in. To each corner is attached a machine steel block, ¾-in. cube, equipped with a nylon sleeve bushing through which pass the ½-in. drillrod guides.

The table is half-inch ground stock, 6 x 8 in., and has attached to it four steel blocks ¾ in. square by 1¼ in. long. Half-inch holes are drilled through these blocks parallel to the table length. The guide rods pass through these holes and are secured by setscrews. Cross holes are also bored through and equipped with nylon bushings for the transverse guide rods. Stop blocks, ¾-in. cube, are also attached to the underside of the table, through which the transverse rods pass and are secured by setscrews. A tie plate of 1/16 x 6 x 6 steel is screwed to the bottom of the guide blocks for rigidity.

The table can move freely a distance of 2 inches left to right and 1½ inches front to back. The nylon bushings may be replaced by Teflon for slightly easier movement, but these will not support so heavy a load as nylon. For light work we fit two handles to control table movement, but for heavier work we attach a bracket to the long edge of the table, through which passes a single handle with a rounded end that engages a spherical seat in a bracket attached to the machine table. This provides a joy-stick control with more leverage than the direct handles.

The top of the table is tapped with a pattern of No. 10-32 holes for attachment of workholding fixtures. A follower of the same diameter as the cutter to be used is held in a clamp bracket attached to the milling head and provided with a long slot for adjustment.

In operation, a templet is attached to the workholder, and the work is located by suitable means so that pieces always lie in the same position. All the operator has to do is to manipulate the table to keep the follower in contact with the templet as he traces around its outline. The base is, of course, attached to the miller table.

K Haller, Millington, NJ

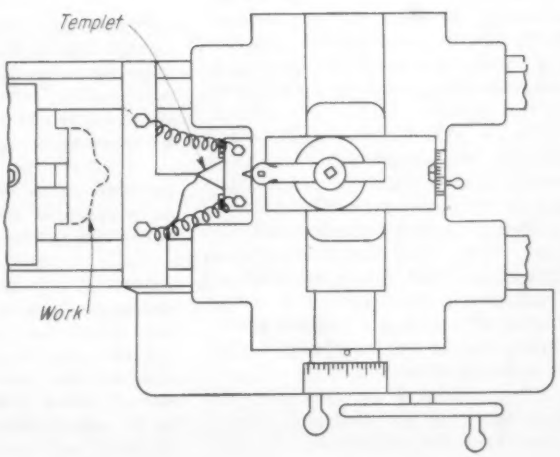
Setup Permits Contour Turning on Engine Lathe

For short runs on parts with a convex contour, this arrangement has proved to be simple and economical. For the sake of clarity, the carriage is shown moved over to the right. In actual practice the templet would be positioned under the chuck to permit the cutting tool to contact the work.

The templet can be cut from sheet brass and attached to the ways by hook bolts or by straight bolts passing through a strap clamp under the bed. The stylus is made of CRS, case hardened. In many cases it is not necessary to drill and tap the carriage because the mounting holes for the follow rest can be used for holding the stylus.

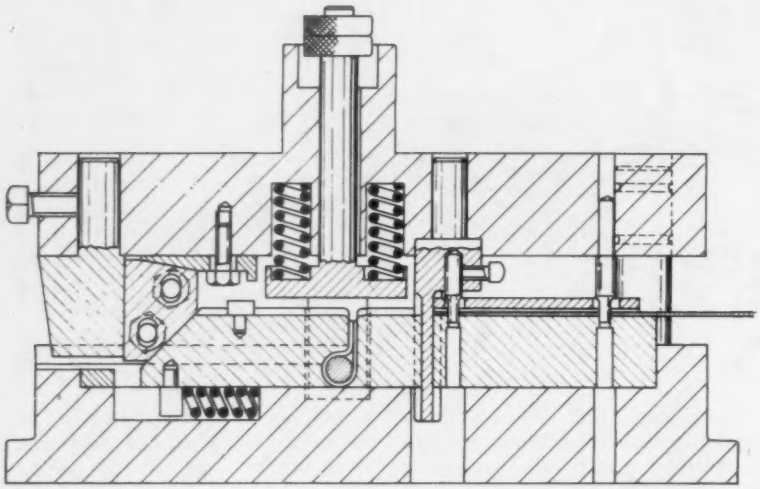
Contact of the stylus with the templet is maintained by lightly tightening the carriage, although a pair of springs may also be used, as shown. All in-feeding is done by advancing the compound rest while the cross-slide moves the tool across the face.

Conrad Costigan, Brooklyn, NY



Practical Ideas

Combination Die Cuts and Forms Clips



Small clips for automobile oil lines are usually produced in two operations. This die is designed to pierce, cut off, and form in one.

Stock feeds from the right and two holes are punched. The inner punch is carried in a cutoff punch which rounds the leading edge of the stock and, at the same time, rounds and cuts off the trailing edge of the preceding blank. As the ram descends, a round mandrel carried on a spring-loaded holder forces the blank between the two lower forming-die sections, forming it into a U shape. Then a wedge on the punch holder contacts the lefthand forming die, moving it to the right to wrap the blank further around the mandrel and produce the right-angle bend. The mandrel remains stationary during this part of the stroke, downward movement being absorbed by the springs.

On the up stroke, the left-hand forming die is pushed back by a strong spring that bears against a pin in its lower face. The mandrel is then free to lift the finished part clear of the dies. There is sufficient springback that the work does not bind on the mandrel and it can be blown off by an air jet, although a stripper may be incorporated if it is considered advisable.

The left-hand forming die also carries a stop pin on its top face, so positioned that, when the die is in its extreme left position, the pin will act as a length gage for the stock. The operating wedge is adjustable by a small wedge attached to the punch holder and is backed up by a heavy block.

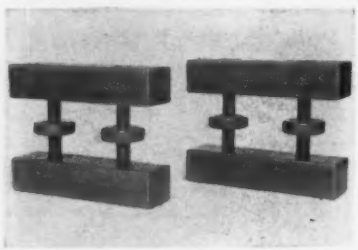
Hjalmar Dahl, Upplands Vasby, Sweden

Adjustable Parallels Aid Die Assembly

We have long had a problem with sliding diecasting dies into very closely machined cavities in the die blocks. We used all kinds of jury rigs to shim up the die to the exact height of the cavity, but frequently got binding and burrs on the edges.

We finally made up these adjustable parallels which have a wide range of adjustment and can be set very finely. The jack screws have fine-pitch right- and left-hand threads at their opposite ends, and large knurled rings at the center. By turning both rings together we can raise or lower the die as needed. One set is used at each end of the die.

Carl S Frank, Clark, NJ



PRECISION EXPANDING MANDREL
Was the winning entry in the Sept 18, 1961 issue.

The $25 prize is awarded to:
E W Swanson Jr, San Jose, Calif

AN EXTRA $25 will be paid for the best Practical Idea in each issue of American Machinist/Metalworking Manufacturing. All items appearing on the Practical Ideas pages are eligible. In case of a tie, duplicate prizes will be awarded.

PAYMENT—will be made as soon as tabulation is completed, and is in addition to the regular rate for the item published.

JUDGES—are a group of American Machinist/Metalworking Manufacturing readers who select articles they prefer in a particular issue. The group changes entirely with each issue and thus represents a true cross-section of readers. Their decision is accepted by the editors, without reservation or bias, as final in each case.

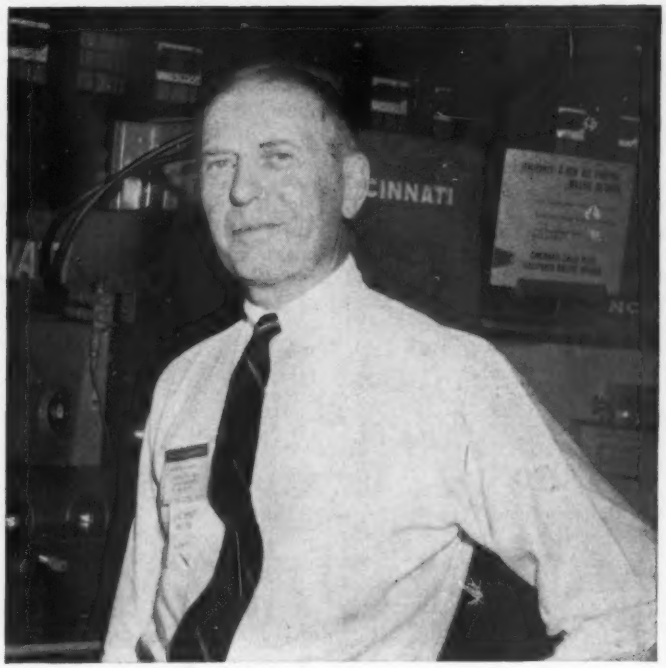
REQUIREMENTS—Items must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with AM/MM standards, and readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: Practical Ideas Editor, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, NY. Please make sure that your name and address are included.

Frederick V Geier

Guiding the world's largest machine tool building company through fat years and lean is a job that requires an extraordinary combination of foresight, technical knowledge, business acumen and diplomacy. Meet the man who has displayed all these qualities and more in his better than a quarter century as . . .



Chief of The Mill

It was shortly after the turn of the century at the then-young Cincinnati Milling Machine Co. In the 20 years or so since he founded it, Fred A Geier had almost always dropped into the plant to answer his mail before going to church on Sunday morning.

Often he brought along his young son, Frederick V Geier, who spent his time wandering through the shop while he waited for his father. It was a good idea, the elder Geier thought, to let the boy nose around and get the feel of things. He could not foresee that the boy would one day head the world's largest machine tool company. Or perhaps he could—the Geiers have had the gift of foresight and anticipation to an extraordinary degree.

Frederick V Geier was born into the proud tradition of the Tool Builders of Cincinnati less than a decade after "The Mill" itself was born out of a shop in a brick shed behind one of Cincinnati's famous old German concert halls.

It was a strange beginning for the company, 77 years ago. Fred A Geier, a young Kansas bank clerk, had come to Cincinnati to settle his father's estate. Among the outstanding debts was one incurred by a little machine shop with a big name, the Cincinnati Screw and Tap Co. When Geier arrived on the scene, the little shop had just been through an Ohio River flood and a disastrous fire, and its finances were shaky.

It is not sure whether he ever did collect the debt, but Fred A Geier saw possibilities in the little shop, which had a dozen machinists at work on various projects, one of which was building a small milling machine for the shop's own use.

First step forward

Within a short time, Geier persuaded the senior partner to dispose of the screw and tap business and to concentrate on the manufacture of milling machines. By 1897, the newly renamed Cincinnati Milling Machine Company had already walked off with a gold medal at the Brussels Exposition and was beginning to achieve an international reputation for product quality.

The company was already well on its way to machine tool preeminence when young Frederick V Geier, complete with Phi Beta Kappa key and a diploma from Williams College, joined it in 1916. (Incidentally, he subscribed to and read AMERICAN MACHINIST all through his college days.)

He had been with the company scarcely a year when World War I broke out. He promptly joined the Army and served as an Ordnance sergeant until 1919.

From then until 1934, when he took over the presidency of the company upon the death of his father, Frederick V Geier served in capacities from clerk to vice president and general manager.

His deep-seated respect for the traditions of American craftsmanship, coupled with an exceptional talent for business and technology, were to make him a fit successor to the man who brought a tiny shop into international prominence.

(Continued on next page)

Geier would one day later write, "All through the ages man has sought to increase his power and ease his work by making and using tools. The advance of civilization has depended not alone upon the progress of man's ideas, but upon the availability of the tools and machines needed to carry those ideas into effect."

The 77-year-old Cincinnati Milling Machine Co has achieved its greatest growth here and abroad under Frederick V Geier's leadership. In the post-World War II years, for example, while the U S machine tool industry as a whole increased its output by 50%, Cincinnati Milling upped its volume 270%. Today the company has 10 plants in the U S and seven overseas.

Expansion abroad

Since Frederick V Geier took over the presidency in 1934, the company has formed Cincinnati Milling Machines Ltd in England (five times expanded since), and Heald Machines Ltd in England in 1957; has acquired the British pressbuilding firm of Hordern, Mason & Edwards Ltd; formed Cincinnati Nederland NV in 1954, and Cincinnati-Chomienne in France two years ago. Even more recently, The Mill acquired Weatherley Oilgear Ltd's facilities at Biggleswade, England.

At the opening of the Dutch plant (Cincinnati-Nederland NV, Geier made a big hit by memorizing and giving a speech in Dutch, which he doesn't speak.

At World War II's end, The Mill formed Cincinnati Lathe & Tool Co and began building economy-priced lathes. Then, in the middle 50s, the assets of The Heald Machine Company were acquired—all this on top of a tremendous expansion of the parent company and its divisions, which range in product scope from mammoth transfer machines to millers and grinders, and to grinding wheels, cutting fluids and other chemicals, reinforced glass fiber plastic moldings, and printed circuit boards.

It's people who count

Geier is a man with unusual talent for choosing topnotch executives, technical people and workers —and for keeping them. Back in the 30s, for example, Cincinnati Milling set up a "bad times" fund. Its purpose: to keep men at work and "things going generally" when the going got rough. The company drew on the fund for the first time during the 1958 recession—even though it did manage to wind up the year in the black.

As Geier himself says, "It is the people who have made this company. It is the combined skill and craftsmanship of everyone, plus their desire to turn out the best product possible."

But if Frederick Geier admires the people who work with him, the admiration is mutual. Says one longtime associate of him:

"His mind is imaginative and practical at one and the same time. He has an uncanny knack of being able to spot a mistake in a plan, a design or a manuscript. He is a real executive, with the respect of his employees, and is not adverse to taking off his coat and pitching in with them on any kind of a problem. And he seems to arrive at a proper conclusion faster than most men get up steam enough to cogitate a problem."

Not only has Geier built up such loyalty among the thousands of employees of The Mill and its subsidiaries—he has made friends for The Mill around the world by bringing in young men from other countries to train in the company's extensive (there are 24 in all) apprentice and technical training programs.

Foresight pays off

The men of The Mill have faith in the good business sense and executive ability of Frederick Geier. "He's a real perfectionist," they'll tell you in Cincinnati. And they have come to respect mightily his uncanny knack of knowing where to expand and when to expand. The year he took over the presidency, for example, Cincinnati became the first U S builder to manufacture machine tools outside the United States (Lapointe had set up a plant in England earlier but only for the manufacture of broaching tools). The company's Birmingham, England, facility, built in the depths of the depression, is today the largest manufacturer of milling machines in the British Commonwealth.

Then there was the time Geier sank a considerable chunk of The Mill's operating capital into a new foundry, which many people considered unnecessary. Not only has it since paid for itself many times over, it has become a model for other iron foundries all over the world because of its many innovations.

But foresight is the forte of Frederick Geier and his executive team. On the economic side, The Mill is solidly established in the British Commonwealth and in the European Common Market area—and of course in the United States and virtually everywhere that metal is machined.

This same vision extends into research and development of new metalworking techniques. Long ago, Cincinnati Milling sensed the interest in, and trend toward, "chipless machining." The company has been in the forefront of such widely accepted developments as numerical control and electrical discharge machining. And it has been the first to research the metal-cutting techniques of the future: sub-zero machining, hot machining, and ultra-high-speed machining.

As might well be imagined, the head of the world's greatest machine tool empire is the busiest of men, traveling abroad at least twice a year to visit The Mill's British, Dutch, and French plants. Recently he was in the Far East. Yet he holds, or has held, many school and college trusteeships, and directorships in a variety of companies, civic and industrial organizations.

He has served his industry (treasurer, vice president and, at the time of Pearl Harbor, president of the National Machine Tool Builders' Association), his community (Director, Community Chest of Cincinnati; Chairman, Museum of Natural History), and his country long and well (Machine Tool Industry Advisory Committee of the Munitions Board, ECA Industrial Advisory Committee, Business Advisory Council to the Department of Commerce).

The full life

This is only a random sampling of the civic, industrial and governmental advisory offices Frederick Geier has held in the last two decades or so, but today, a rugged 68, he continues to like the full life. In fact, he and Mrs. Geier (they have two sons, two daughters and 16 grandchildren) still enjoy canoe and fishing trips in the wilds of Nova Scotia.

Yet with all his extracurricular activities and the responsibility of running the world's foremost machine tool company, Geier finds time for deep concern over the future of America and its industry.

Fourteen years ago, speaking at the Rochester Institute of Technology, he warned, "We must speak with a firm voice, with the strength of purpose and industrial power to back it up. The high productivity that brings national strength challenges all the energy and ability we

can bring to the task . . . We must be alert to improve what we make and how we make it.

"Everywhere we look we see how great is the gap between what is and what could be . . . If we could bring all production up to our best records, if we could show how much more man can achieve than he is doing, what a different America, what a different world this would be."

Once again, the very quotable Mr Geier, speaking two years later before the Newcomen Society of America, said, "The machine tool has given man the mastery of power and of metals. Often we speak of the Steel Age, the Age of Electricity, the Automobile Age, the Air Age, the Atomic Age. When we look closer, we see that this in reality is the Machine Tool Age."

During his Newcomen address, he told of the contributions made by such eminent Cincinnati machine tool men as George A Gray, J A Fay, Henry Bickford, William ("Uncle Billy") Lodge, Fred A Geier, and Richard K LeBlond.

Characteristically, he failed to name another who has made Cincinnati so eminent in the machine tool world—Frederick V Geier. •

Names in the News

Gleason Works, Rochester, NY, has appointed **Howard F Carver** vice president and general manager. Mr Carver, previously a vice president of the company, had also held the position of assistant general manager

Birdsboro Corp, Birdsboro, Pa, manufacturer of heavy presses and machinery, has elected **Robert W Frank** president to succeed **G Clymer Brooke** who has been named chairman of the board. Mr Frank was formerly vice president of the firm.

E W Bliss Co has appointed **Richard E Rassel** Detroit district sales manager for the Press Division. He succeeds **J L Chase** who was recently named manager of container machinery sales. Mr Rassel was formerly manager of automotive press sales.

DoAll Co, Des Plaines, Ill, has named **John Suerth** product manager for cutting oils, lubricants, and coolants. He was formerly a research chemist at Universal Oil Products, Des Plaines.

Crown Machine & Tool Co, Fort Worth, has named **Fred O Detweiler** president. He recently resigned from his post as president of Chance Vought Corp.

Clearing Division of **US Industries** has named **Karl E Peglow** vice president, manufacturing. He was formerly director of manufacturing at Clearing. Prior to that, he was general manager of U S Industries' Rockford Division

Kerns United Corp, Calumet City, Ill, manufacturer of specialized industrial lubricants, has named **B L Smalley** president. Formerly general sales manager, he succeeds **Bruce W Glenn** who was recently named president of **Kerns Lubricants Ltd,** Toronto, a newly formed Canadian company.

Cone Automatic Machine Co, Windsor, Vt, has named **Stanley A Brandenburg** domestic sales manager. He was previously president of the Brandenburg Machinery Co, Dayton, Ohio, where he also acted as a consultant in machine tool design

Cincinnati Milling Machine Co has appointed **Louis E Eberts** president-directeur of **Cincinnati-Nederland N V** (Dutch subsidiary). He has been assistant export manager, and vice president of Cincinnati Milling & Grinding Machines

Emhart Manufacturing Co has appointed **James H Taylor** general manager of the Portland, Conn, Di-

(continued on p205)

Harron, Rickard & McCone Co of Southern California has appointed **Joe Bungartz** vice president-sales manager. He has been associated with Cincinnati Milling Machine Co for 23 years and for the past 11 years has been western district manager

Part: Stud

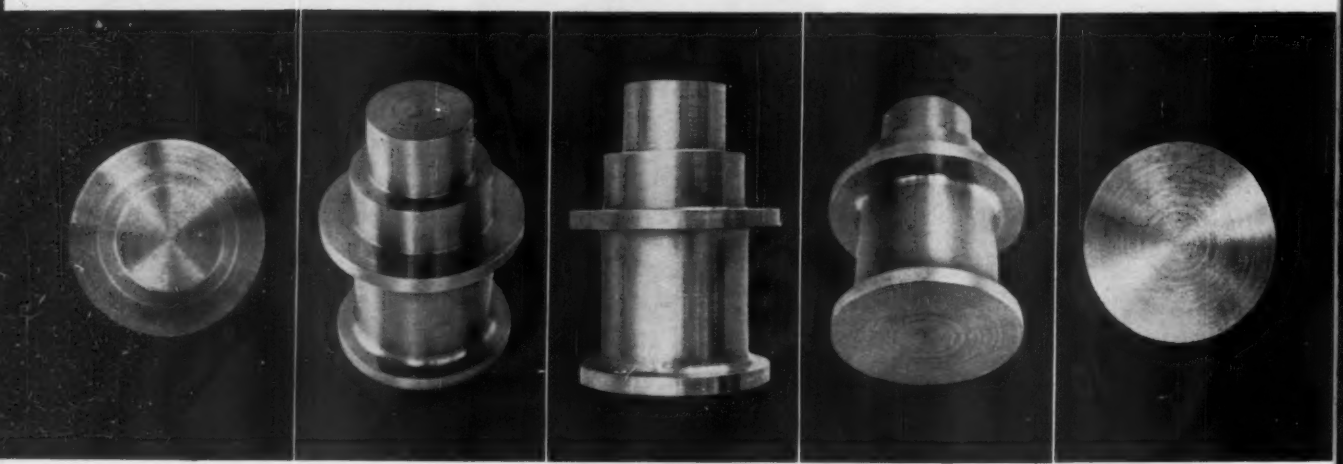
Screw Stock: ½ in. BETH-LED round, cold drawn

Chip Removal: 52.5 per cent

Cutting Speed: 289 SFM—up 25.2 per cent*

Production Rate: 2000 pieces/hr—up 35.7 per cent*

*Over the control stock: C1213 non-leaded steel



BETH-LED

Beth-Led bars machine at least 20 per cent faster than non-leaded steel on parts such as the stud above. On bar automatics, this *leaded* carbon screw stock will go a long way toward boosting your production by speeding metal removal and lengthening tool life. Chip control is excellent. Machined finish is tops.

Cut *your* production costs with Beth-Led. Beth-Led is available for fast-delivery . . . cold-finished as distributed by non-integrated cold drawers . . . or hot-rolled, as produced by Bethlehem.

Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Dow Industrial Gas Gives Faster Cutting Speeds, More Economy Than Acetylene

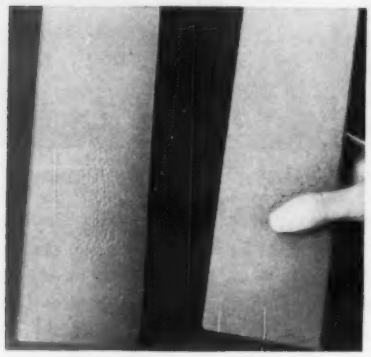
Operating economies from 15 to 45 percent are offered by stabilized methylacetylene marketed under the name of MAPP. The gas combines the high energy characteristics of acetylene with the handling and safety of propane. Although it is a member of the acetylene family and can be liquified and handled in regular LPG equipment it is not a formulated acetylene or propane. The components of the new gas are methylacetylene, propadiene and related compounds. Besides being safer and cheaper than propane the gas gives faster cutting speeds than acetylene and has about the same flame temperature as acetylene.

Like acetylene and propane MAPP has a heat combustion of about 20,000 BTU per pound. It can be used at pressures up to 300 psig and has an oxygen consumption of 2.3 parts oxygen to 1 part MAPP, which is about the same as acetylene on a weight basis but less than the consumption rate of propane.

The flame obtained with MAPP is said to be easier to light and adjust than propane, and backfire and flashback are said to be practically impossible to cause.

Dow Chemical Co, Midland, Mich

MORE DATA? Circle 96, inside back cover



Silicone Release Agent Easily Removed Prior to Painting

Silicone parting agent that combines a high release efficiency with a high degree of compatibility for paints, finish coats and adhesives is available in two forms—Dow Corning 230 Fluid, or Dow Corning 231 Emulsion.

Cleaning methods normally recommended for removing oil or grease from any surface prior to painting will prepare the silicone coated area. In the illustration above conventional silicone release agent was rubbed onto the panel at left and Dow Corning 230 Fluid rubbed onto the panel at right. Both panels were cleaned by vapor degreasing and then spray painted. Surface on the right gave greater wettability.

When surfaces are cleaned of the new silicone fluid there is no marked change in the adhesive value of cements and glues used to bond parts released from molds treated with the fluids.

In most release applications the new fluid is applied by spray or brush after solvent dilution. Dilutions of one part of 230 Fluid in 50 to 200 parts solvent are effective.

The fluid and emulsion are now in use as release agents for industrial rubber parts and plastic laminates, and as automotive rubber lubricants.

Dow Corning Corp, Midland, Mich

MORE DATA? Circle 97, inside back cover

American Brazing Alloys Adds Two New Alloys to Line

Ambraze nickel silver alloy combines increased fluidity and penetration for greater economy and better performance in the fabrication of bicycles, tubular steel furniture, and instrument parts. The alloy, which has a melting point of 1700 F, possesses a tensile strength of 67,000 psi and is available in 10-lb cartons. Sizes 1/16, 3/32, ⅛, 3/16, and ¼ in. are offered in both 18 and 36-in. lengths.

Also offered is a new alloy specially designed for copper to copper joints. Pos Sil O is a thin flowing rod that is said to provide fine corrosion resistance, high ductility, and high electrical and heat conductivity. Melting point for the alloy is 1305 F, tensile strength is 93,000 psi and it can be used on copper-to-copper joints with no flux. It is available in 25-lb cartons in sizes ¼, 3/16, and ⅛ in. (round or square) in standard 36 in. lengths.

American Brazing Alloys Corp, P O Box 11, Pelham, NY

MORE DATA? Circle 98, inside back cover

Aluminum Clad Steel Allows Welding of Aluminum to Steel

Aluminum clad low carbon steel allows joining of aluminum components to steel components by welding. In this application the aluminum components are welded to the aluminum side of the clad metal and the steel components to the steel side. Coated electrode welding is recommended for welding the steel side of the material and the electrodes should preferably be of the easy starting type to avoid heating the aluminum to the melting point. When welding the aluminum side, any conventional fusion welding process may be employed.

The clad metal is available in widths up to 12 in; thicknesses to 0.100 in. and with aluminum layer up to 50% of the total thickness.

Metals & Controls, Inc, 34 Forest St, Attleboro, Mass

MORE DATA? Circle 99, inside back cover

Protective Coating for Aluminum Resists 400 Hours in Salt Spray

A clear non-yellowing protective coating for use on aluminum gives resistance to over 400 hours of salt spray and seven days exposure to fresh mortar.

The protective lacquer is applied by spraying or brushing and air dries to a smooth clear protective skin. Coated pieces may then be colored by a simple dip and rinse operation with no further operational steps. The company says that coated aluminum trailer bodies showed no weathering or pitting after 18 months of exposure to normal weather and use.

The coating is designated as RES-N-Lac No. MC and is supplied in 5-16 gallon pails and 55-gallon drums.

Schwartz Chemical Co, Inc, 50-01 Second St, LIC 1, NY •

MORE DATA? Circle 100, inside back cover

How the Lindner Jig Borer's Optical Measuring System reduces tooling costs

at F. J. Stokes

Lindner Model LB15A has 44" x 24" table with exclusive AUTOPOSITIONER® for pre-selecting initial and repeat table settings.

Production Jig Boring and Inspection at Stokes—51 holes, .750" diameter, 9" to 15" deep, in head of rotary tablet machine held to +.0005", —.0000" on Lindner Model LB15A. Holes are perpendicular to the base and parallel to each other within .0005".

"Greater accuracy in jig boring proved to be the key to more economical tooling," says Bill Kale, Chief Production Engineer at F. J. Stokes Corp., Philadelphia. "When we installed a Lindner, costs were substantially reduced."

How does the Lindner achieve this greater accuracy? Through a unique optical measuring system. Here's how it works:

There are no lead screws. No gage blocks. No bars or limit switches. The helically scribed, cylindrical measuring scales are touched by a light beam *only*. These scales are independent of the table movement mechanism and immovable in axial direction. Thus, the whole system is permanently protected against any mechanical wear whatever. Lifetime accuracy. And lifetime *economy!*

Says Mr. Kale: "Before installation of the Lindner, it was impossible to achieve such consistent accuracy. Manufacture of tooling and laying out complex jobs has now been greatly simplified. And the Lindner optical measuring system makes it possible for us to inspect the work *right in the machine.*"

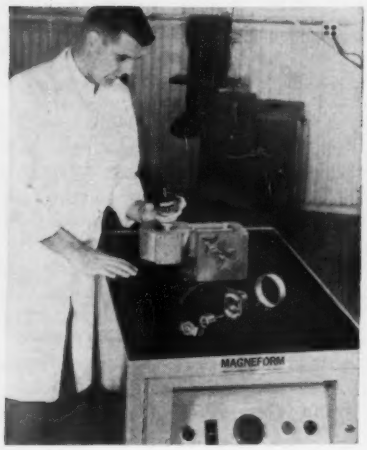
The Lindner optical measuring system is changing ideas about jig boring all over the country. We've packed all the facts into an informative 25-minute movie film. Send for it today without obligation, or write for literature.

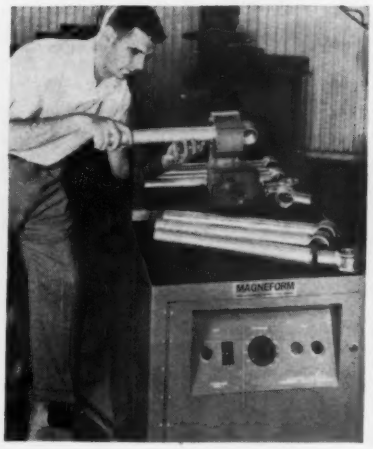
KO CO., INC. PRECISION MACHINERY

KURT ORBAN COMPANY, INC.

CIRCLE 346 READER SERVICE CARD

1259 U.S. Route 46, Parsippany, New Jersey





General Dynamics Magneform Machine Shapes Metal Parts With 300 Kilogauss Pulse

The Magneform machine utilizes a magnetic field to shape metals at very high rates and under extremely high pressures. With the pulses from a bank of capacitors contained in the 4 by 2 by 3-ft console the machine creates pressures ranging up to more than 50,000 psi for durations of 10 to 20 millionths of a second. The machines now being produced permit one such operation every six seconds including recharging of the capacitor. With automated operation the process can be speeded up.

Operating on conventional 220-volt, 60 cycle power source the machine creates a magnetic field of up to 300 kilogauss. This field can be used to assemble groups of separate components by encasing them in metal containing bands, (left) and can also perform swaging or expansion along the length of the workpiece (right).

Since uniformity of the pulse depends upon coil design the coil can be formed to provide a force that is non-symmetrical in either or both the circumferential or longitudinal directions. Embossing, forming or blanking can also be done with simple tooling; a flat or shaped coil will push the metal into or over a simple die.

One great advantage in swaging or expanding operations is that the machine does not contact the work at any time. Therefore, scratching or marring of the surface is eliminated and, in addition, work can be done through the walls of a container, so that swaging of reactive materials can be carried out in a vacuum or reactive atmosphere.

Operation of the machine is extremely simple. To fit an aluminum ring around several motor components the components are assembled and placed with a loose fitting ring inside of the forming coil. After the voltage is preset a single pulse fits the aluminum containing ring tightly around the components, holding them together.

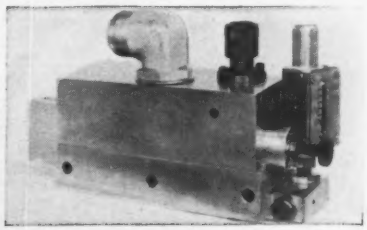
For operations of this type the wall thickness of the assembly ring should be under 0.025 in., but if necessary the machine can handle up to 0.050-in.-thick rings. With the standard coil the height of the ring should be 2 in. or less and the diameter should be under 6 in. Larger dimensions than this can be handled with special coils.

Coils for the machine, which can be made flat, cylindrical and in several other shapes are readily interchangeable. Time to change coils is said to be a maximum of five minutes.

The machines will be made available to industrial users under lease at about $6,000 a year including maintenance.

General Atomic Div of General Dynamics Corp, P O Box 608, San Diego 12, Calif

MORE DATA? Circle 51, inside back cover



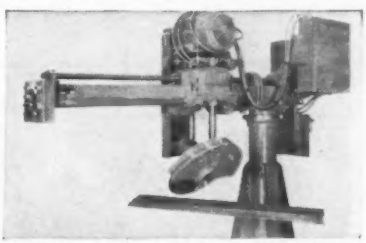
Press Intensifier and Cushion Valves Boost Die Pressures

Series of press intensifier and die cushion valves are fixed to the ram of hydraulic and mechanical forming and stamping presses and act as pressure booster so that the die can exert more controlled pressure on the metal blank. The Hydro-Die unit is composed of an aluminum-bodied valve, a small oil storage tank and a low pressure air line connected to the tank and pistons by a patented aluminum safety dieconnect. Aside from creating additional pressure the units permit; gradual unloading of great quantities of oil without valve bounce, cushioned impact, prevention of air in the system from converting to foam, and automatic unloading of oil at low pressure if the press operator errs.

The Hydro-Die valves are available in a range from 3 by 4 by 5 into 10 by 12 by 20 in. Cushions are available up to 24 by 30 by 60 in.

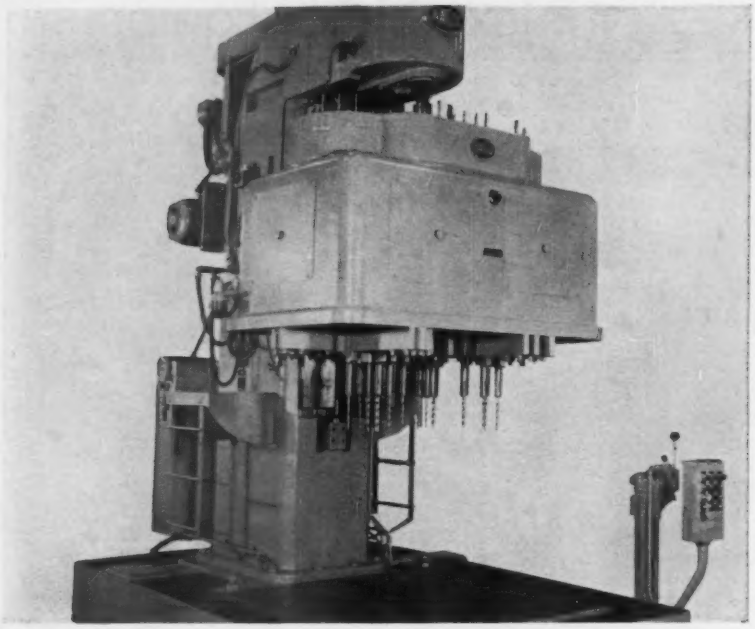
Di-Dro Engineering, Inc, 2405 E Grand Blvd, Detroit 11, Mich

MORE DATA? Circle 52, inside back cover



SWIVEL RAIL MITERING MACHINE known as the 111DTA, carries up to a 30-hp motor and a 30-in blade. The rail swings manually to 45 degrees either side of 90 degrees. The machine is available with a swivel nose arbor permitting end slotting, miters, compound miters and straight cutoff work *—Ty-Sa-Man Machine Co, 1001 White Ave, Knoxvile, Tenn*

MORE DATA? Circle 53, inside back cover



Natco Hydraulic Feed Drilling Machines Compensate for Fluid Temperature Changes

Complete new line of vertical adjustable multi-spindle drilling and tapping machines are buit in a variety of basic sizes ranging from 5 hp to 30 hp with thrust capacities from 8,000 to 25,000 lbs.

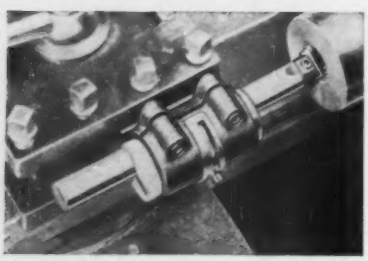
The machines, which conform to both JIC and building block principles, have heads equipped with independent change of spindle speeds that give two speeds and neutral for each spindle.

Head drive speeds may be changed by either an electrical clutch or a manual shifting mechanism, a feature that makes possible a high or low drive shaft speed and provides four different spindle speeds with each set of change gears.

Hydraulic feed control gives infinitely variable feed rates over a range of 1 to 30 inches per minute and rapid transverse rates up to 275 ipm. Hydraulic fluid is metered through feed apertures for fine adjustment and there are pressure and temperature compensating elements in the control panel so that uniform feeds are assured regardless of variations in fluid temperature or system pressure.

National Automatic Tool Co, Inc, Richmond, Ind

MORE DATA? Circle 54, inside back cover



Everede Line of Boring Barholders Fit Lathes With 7 to 24-in. Swing

Line of boring bar holders for turret, bench and engine lathes are made of case-hardened, heat-treated alloy steel and are adjustable for fitting to various sizes of lathes. An eccentric barrel is part of the setup and can be rotated and clamped into position to keep the bar in a true horizontal position on center.

Bar holders are available with a maximum bar capacity of ¾ to 1 in. diameter. Center height of the bar holders range from ⅝ to 1-13/16 inch.

The bench lathe boring bar holder fits lathes from 7 through 9-in. swing and the engine lathe holder fits lathes from 8 through 12 or from 12 through 24-in. swing.

Everede Tool Co, 2000 North Parkside Ave, Chicago, Ill

MORE DATA? Circle 55, inside back cover

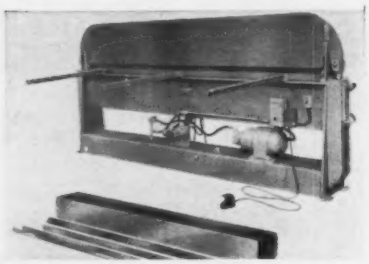
Continuous Strip Film Package Simplifies Inspection Jobs

Continuous strip film is used for the inspection of welded pipe, castings, and parts. Ordinary procedure involves the application of lengths of film in rigid lead casettes that must be darkroom-loaded. Each length of film must be coded for identification of the inspected section or part.

The new Magnaplate product is a flexible X-ray film shielded with plastic-coated lead foil sealed with tape and is contained in a light-tight box which is also an assembling device. As the film is withdrawn, it is automatically covered with the lead foil shielding and tape-sealed. The film is pre-indexed for easy location. Notations can be made over the foil with a ballpoint pen and the inscription will show up on the processed film.

General Magnaplate Corp, Belleville, NJ

MORE DATA? Circle 56, inside back cover



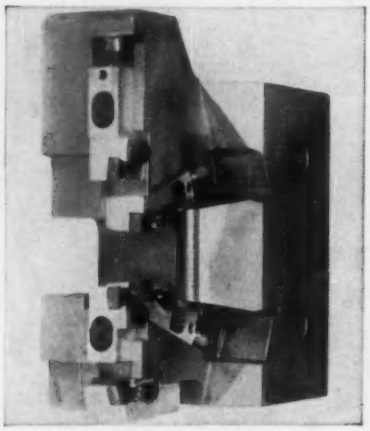
Chicago Hydraulic Speedibender Handles Long, Light-Gage Work

Speedibender, available in four models, is designed for production bending of heating and ventilating duct sections and similar long, light-gage work. Capacities of the machines range from five feet of 18-gage to 10 ft of 24-gage mild steel.

Power operation of the machines is by two cylinders and a balanced vane-type hydraulic pump driven by a 3-hp motor. On-off pushbutton station is mounted on front, and control of the machine is by foot switch. A choice of a two- or three-opening female die is offered; each die has an opening for cross-braking. The die is instantly positioned to bring the desired opening under the punch or male die by two small hydraulic cylinders mounted on the rear of bed surface. A two-way hand switch on front of machine controls movement of the die forward or backward against stop blocks.

Dreis & Krump Mfg Co, 7400 S Loomis Blvd, Chicago 36, Ill

MORE DATA? Circle 57, inside back cover



Block-Type Tool Features Five Disposable Carbide Bits

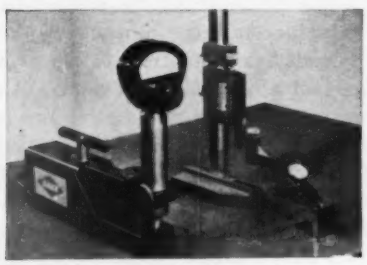
Special block-type tool which positions five adjustable, indexable, and disposable carbide kits is designed to increase production of worm gear blanks. It is currently being used on a W&S turret lathe and finishes four faces of a worm gear blank in a single pass. The gear blank is chucked on the ID. It also provides a tool which is used for a subsequent turning operation.

Tool can be adjusted to close tolerances and can be preset before placing on the machine. Fine adjustments can be quickly made if required.

When cutters dull, all that is necessary to sharpen them is to is necessary to sharpen them is to index one side of the blades. Rectangular negative-type inserts provide eight sharpenings to each blank; the triangular blanks provide six.

Wetmore Tool & Engrg Co, 5320 E Washington Blvd, Los Angeles 22, Calif

MORE DATA? Circle 58, inside back cover



Instrument Checks Surface Plate Accuracy

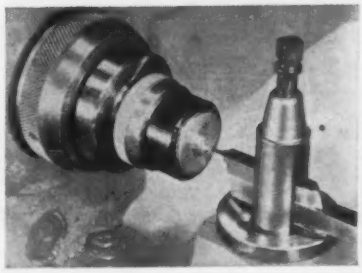
The Repeat-O-Meter is designed for rapid checking of surface plates to determine whether the basic requirement of measurement accuracy is within specified tolerance. Picture shows the instrument being compared to a height gage set on a gage block.

Base is 5 x 2 in. and there are three lapped carbide inserts in the bottom. A 5-in.-long arm, hinged to the base, has one lapped carbide insert under its end. The arm is comparable to the gage block and facilitates movement of the instrument over a surface plate with the "gage block" always in the same relative position. Projecting indicator arm, precisely adjustable by means of differential threads, is bored to take the barrel of a 10 millionths Mikrokator as shown.

In use, the instrument is placed anywhere on a surtace plate and moved about, all over, and full indicator range noted. This indicator range is the error in measure that could occur on that surface plate when using a height gage to inspect a tool.

Rahn Granite Surface Plate Co, 644 N Western Ave, Dayton 7, Ohio

MORE DATA? Circle 59, inside back cover

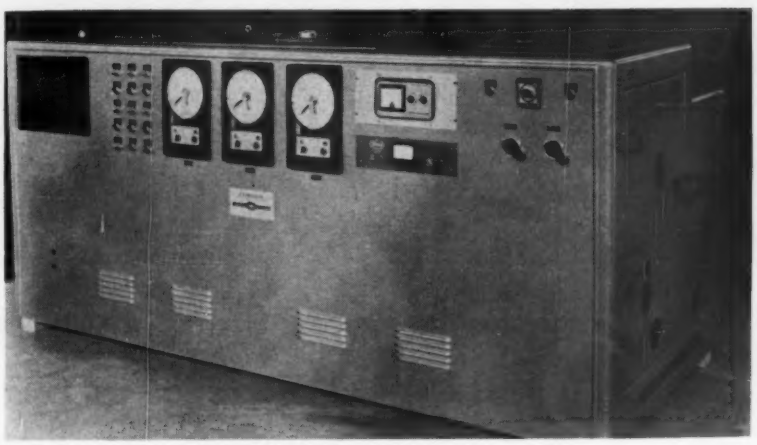


Brown Split Chuck Can Be Used For Variety of Operations

Concentricity, squareness, parallelism, uniform lengths to tenths in turning, boring, facing, and grinding operations are capability features of the Brown Split Chuck. Critical length dimensions can be held since no draw-in action takes place. Run-out of spindles is automatically compensated for and unit can be re-used, re-bored, or replaced inexpensively.

M & H Products Inc, Box 1057, Danbury, Conn

MORE DATA? Circle 60, inside back cover



Hayes Furnace Maintains High Vacuum In Continuous Automatic Heat Treating

Fully automated continuous vacuum processing is possible with the Model Vac-50C vacuum conveyor furnace (*AM/MM* Nov 27, '61 p 3). Except for loading and unloading, the entire furnace operates automatically. The operator periodically places boats into an external conveyor which loads them into a vacuum-lock inlet. From here work is belt-conveyored through the heat zone where it undergoes temperatures up to 1000 degrees C and is then returned to the atmosphere through a vacuum lock outlet.

Temperatures are maintained within ±1 degree C with proportional control instruments which govern three heat zones in the furnace. Control is by the 3-mode system; rate, reset, and proportional band. Control characteristics may be tuned by varying bias control and current limiting. Vacuum attained by the furnace under actual operating conditions is said to be 5×10^{-6} mm of mercury and vacuum maintained under load continuously is reportedly 5×10^{-5} mm of mercury.

C I Hayes, Inc, Wellington Ave, Cranston 10, RI

MORE DATA? Circle 61, inside back cover

Inventory Management Simulator program at...

Clark Equipment... improves customer

■ **High-capacity memory.** Two IBM 305 Data Processing Systems with RAMAC keep track of 75,000 replacement and repair parts in Clark's Chicago parts warehouse. ■ **The computer has the facts.** As soon as shipments arrive at the warehouse, an operator, using this remote inquiry station near the loading platform, finds out from the computers where various items go. ■ **Customer service first.** Using this remote inquiry station in the sales department, the operator gets information from the computer while the customer is on the phone.

Clark Equipment Company has prepared a computer program called an Inventory Management Simulator. The program allows Clark management to study the possible effects of decisions on future customer service and future warehouse profitability. When management gets the computer's report, it is in a position to make new rules for the operation of its parts warehouse.

Here's what's happened since Clark put the new program into operation:... improved customer service... practically eliminated back-order problem . . . reduced the putaway time for incoming material by more than 50 per cent . . . reduced emergency order shipping time by 50 per cent . . . enabled a physical inventory to be taken without any interruption of service to customers.

CIRCLE 347 READER SERVICE CARD

service...with less inventory

Availability highest ever. Inventory management is a complex job at Clark. Its Chicago warehouse is one of the busiest and largest in the country. Before the Simulator program was developed, the warehouse carried an inventory of 85,000 individual replacement and repair parts. Use of the program helped transfer the investment in inventory to those parts most frequently called for, giving high availability with less investment.

Management Operating System.* Clark installed two IBM 305 Data Processing Systems with RAMAC.® These computers store, update, and offer on an instant's notice information on almost every aspect of the warehouse operation including complete information on every one of the 75,000 items maintained in stock.

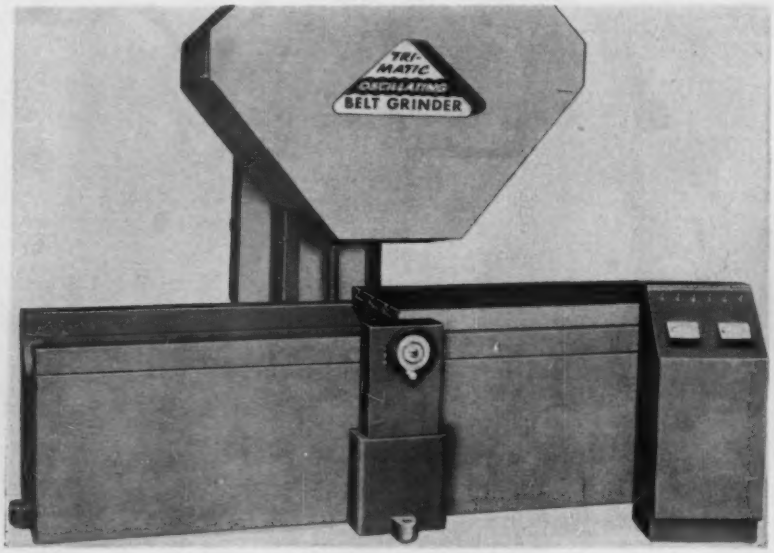
Now, Clark is assured of maintaining just the right level of stock for each item. The procurement formulas, developed from the Inventory Management Simulator, even recommend how large a purchase order should be placed for each item and where it should be placed.

If you have an inventory problem, why not consider a simulation program? You don't have to have your own computer. We can supply you with an Inventory Management Simulator...you can rent time on a computer. Result...improve the profitability of your warehouse operation.

**A Management Operating System uses IBM computers to make routine business decisions and take action automatically ...flags problems that need management's special attention... frees management to concentrate on the big problems and on long range planning. As a result, it gives tighter control of all business operations...and helps cut costs.*

IBM® DATA PROCESSING

CIRCLE 348 READER SERVICE CARD



Oscillating Abrasive Belt Grinder Has Planer-Type Reciprocating Table

This open-side bed-type oscillating abrasive belt grinder has a reciprocating planer-type table that reverses smoothly and eliminates all vibration and backlash. The abrasive belt covers the entire work surface and therefore reduces the time required for grinding a work piece. The table can be provided with T-slots or drilled to hold fixtures and chucks and extra long tables can be supplied.

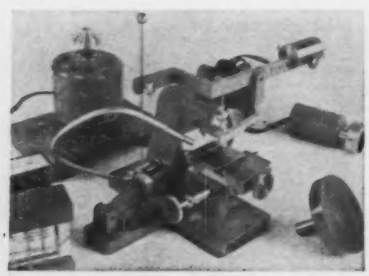
The 3-roll workhead design separates driving, steering and contact functions by providing a roll for each. One roll drives and tensions the belt, the second steers the belt and oscillates it and the third provides the work contact. This roll is free-idling so that it eliminates the transmission of motor and belt vibration to the work surface.

Changing belts is easy because the open side eliminates obstructions and no belt tracking adjustments are needed. After belt change the new belt is automatically tracked when the machine is restarted.

The bed-type grinders with planer-type tables are available in sizes from 12 through 48 in. The illustrated machine is a 24-in. model.

Tri-Matic Div, Sales Service Mfg Co, 2363 University Ave, St Paul, Minn

MORE DATA? Circle 64, inside back cover



Micro Precision Drilling Machine Drills Holes of 0.0001-in. dia

Najet Model 7 A employs neither chuck, spindle, nor bearings as conventionally conceived. Operator is relieved of the drill trueing operation and is guaranteed excellent concentricity. Extremely tight spindle and bearing tolerance is also provided. A micrometer stop, counterbalance, and vibration-proof design enables even an inexperienced operator to drill with excellent results, according to manufacturer.

National Jet Co, Cumberland, Md

MORE DATA? Circle 65, inside back cover

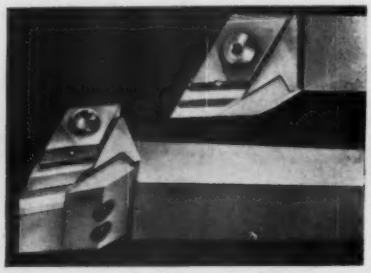
Mekco Thread Gage Is Five-Purpose Tool

This gage with a standard micrometer measures the exact PD of any screw having ANS thread, from 4 to 80 tpi, without interference with the root or bottom flat of the screw thread being measured. It can be used while the workpiece is in the machine.

In addition, it can be used for: setting bits in single point tools; disclosure of leaning threads; measuring concentricity; and revealing drunken threads. Price is $37.50.

R-K Development Corp, 171 S Daisy Ave, Pasadena, Calif

MORE DATA? Circle 66, inside back cover



Profile Turning Tool Takes Heavy Contour Cuts Without Shifting

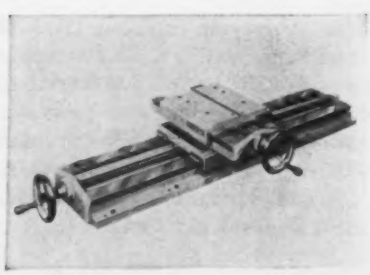
An exclusive side clamping feature on this AGT-85 profile turning tool holds the 55-degree insert firmly so that close tolerances are held even during heavy duty profile turning of tough alloys.

Shank size is 1⅛ by 1¼ in., and the 3/16 in. thick inserts have a 5-degree negative rake and present a full ¾ in. of carbide along the cutting edge. The chip breaker has an adjustable range over 0.057 to 0.187 in. providing chip control within a feed range of 0.008 to 0.22 ipr on most ferrous alloys.

The tool fits the series 60, 61, 610, 612, 62, and model 20-H Monamatic Monarch tracer lathes and is offered as a set which includes two holders, two extra clamps with chip breakers, two extra shims and 20 inserts.

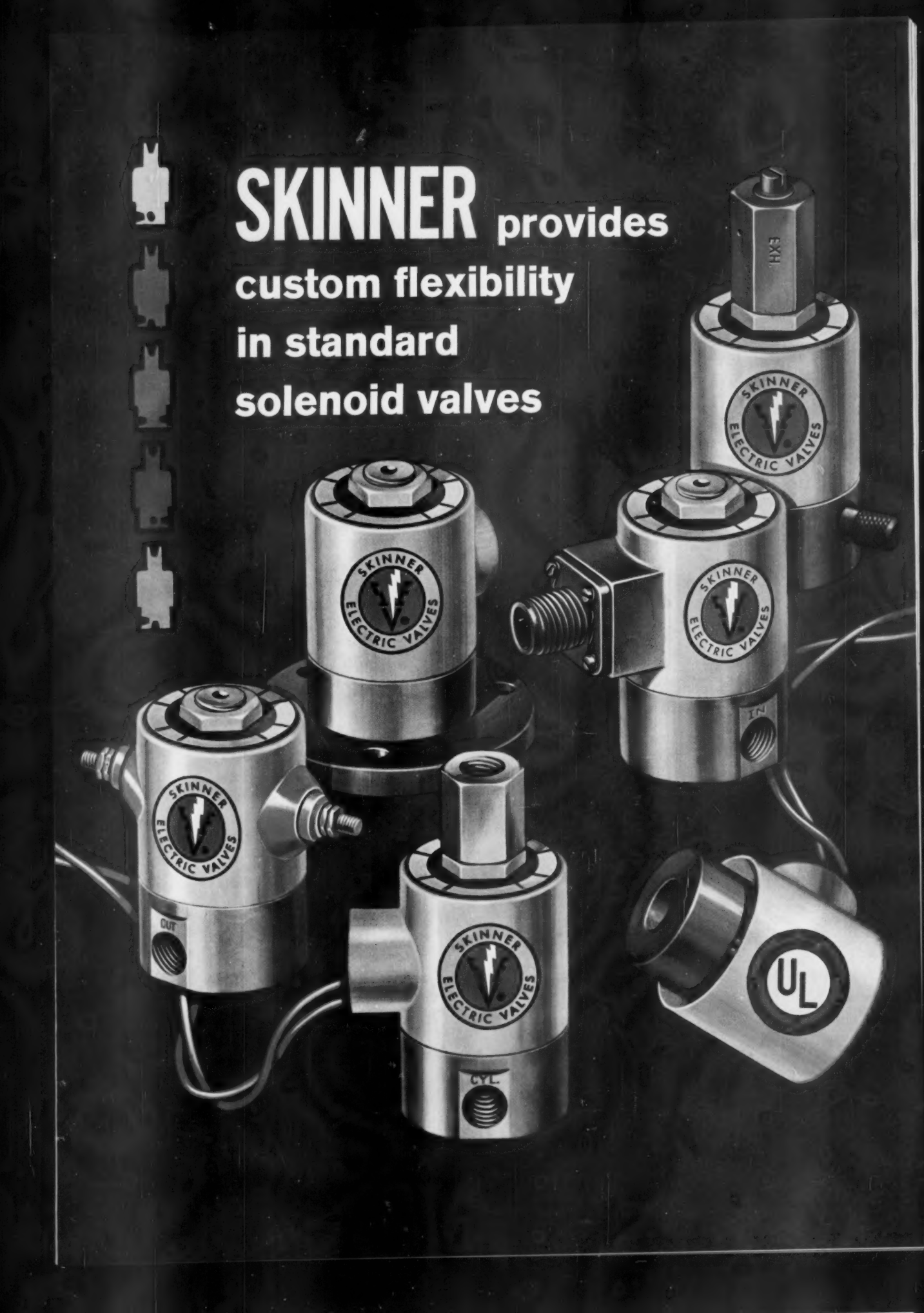
Monarch Machine Tool Co, Sidney, Ohio

MORE DATA? Circle 67, inside back cover



LINE OF MORE THAN 150 MODELS of feed tables incorporate hardened replaceable ways and are offered in a range of travel capacities from 3 in. to 17 ft. Tables are recommended as components for special production machines.—*Master Mfg Co, 1300 East Ave A, Hutchinson Kansas*

MORE DATA? Circle 68, inside back cover


SKINNER provides
custom flexibility
in standard
solenoid valves
SKINNER
ELECTRIC VALVES
EXH.
IN
OUT
CYL.
UL

Versatile, top quality V5, X5 line offers wide range of options

Skinner's two-way and three-way V5, X5 series of solenoid valves has earned the description—"The Universal Line." With more than 100,000 variations possible, V5, X5 valves are available for every conceivable application. And top quality is emphasized with bubbletight sealing, and stainless steel body, plunger and sleeve assembly. Precision machining, unique welding techniques, specially designed and developed machinery and manufacturing methods are all used by Skinner to produce the best valves made. These valves are small, yet handle operating pressures as high as 3000 psi. They accommodate all media that do not corrode stainless steel. And no other solenoid valves offer so many optional features. Check the following options.

FLOW CONTROL

Precise, accurate control of media flow is possible with all Skinner V5, X5 valves. Both two-way and three-way valves are available with adjustable flow in the main stream, and with manual override. Two-way valves are also available with adjustable bypass. Exhaust flow can be controlled in three-way valves.

ELECTRICAL HOUSINGS

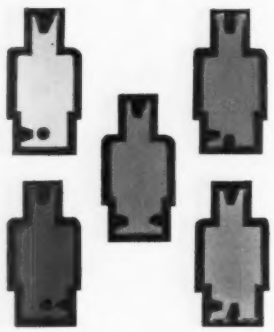
Skinner offers an electrical housing for any application. Some of the most common are:

- standard ½" NPT conduit
- grommet outlet
- single or double automotive terminals
- JIC housings with integral junction box
- AN connector for military applications
- strain relief connector for quick disconnect

All housings are steel, plated for wear and appearance, and can be rotated 360° for easy installation.

PORTING

Restrictions of installation or application, and mounting are minimized because Skinner provides a wide variety of port location options. V5, X5 valves are available with ports at right or left angles, on bottom, top, and sides for virtually all combinations of flow.



MOUNTING

Skinner V5, X5 valves are provided with tapped holes for normal mounting, with mounting brackets for panel or other surface, or with flange for direct mounting without threaded pipe connections.

The Skinner V5, X5 series of two-way and three-way solenoid valves provides top quality design with orifices from 1/32" to 3/8" diameter, normally open, normally closed, dual purpose, directional control and multi-purpose, in standard and explosion-proof construction. Also included in this line is a three-way quick-exhaust type which is designed with an additional port to exhaust cylinders 4 times faster than standard types.

COILS

Skinner V5, X5 valves are available with coils of many types for most DC and AC voltages at 25, 50 and 60 cycle frequencies. Whether your requirements are for continuous or intermittent performance, in tropical, high moisture or high temperature environments, or for dual voltage, Skinner UL approved coils are available with leads of several types and lengths.

• • •

Typical applications—machine tools, cylinder control, instrumentation and automation of all kinds, laundry equipment, aircraft and missiles, etc. For catalogs and complete information contact a Skinner Distributor listed in the Yellow Pages or write us at the address below.

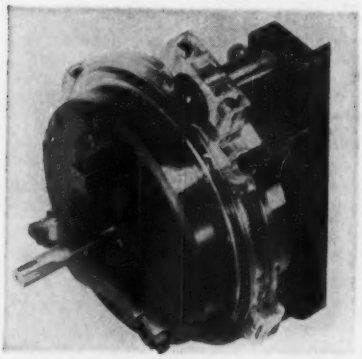
When you specify solenoid valves, specify Skinner. Skinner solenoid valves are distributed internationally.

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION,
THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT, U.S.A.

PRINTED IN U.S.A.



Air Coupling Designed for Use On Chucking Equipment

The Idler air coupling, for use on chucking equipment with self-contained air cylinders, is periphery controlled and air actuation is accomplished by inserting air through the cylinder wall. This design permits the center of a chuck to be open for through feeding of bar stock or for gaging equipment.

The standard cylinder is replaced with a recessed cylinder which contains intake and exhaust air ports. An air supply ring with O rings on each side is clamped into position in the recessed cylinder. Split clamp lobe on the idler ring is provided for alignment with a spherical joint to simplify the attachment of the crank-type support to the headstock of the machine. Air supply is connected with a flexible hose.

NA Woodworth Co, 1300 E Nine Mile Rd, Detroit 20, Mich

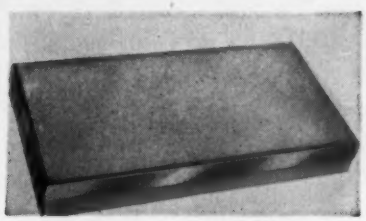
MORE DATA? Circle 69, inside back cover

Lietz Auto-Collimator Gives All Readings With Same Ocular

Biaxial auto-collimator simplifies measurements with a diagonal direction of the minute scale in the ocular, thereby eliminating measurements in two axial planes. The biaxial arrangements requires only one measuring motion which gives the reading in both coordinates without rotating the ocular or the telescope tube. Since all readings—for minutes and half seconds—are obtained within the same ocular without shift of the operator's eye, speed and accuracy of operation is reportedly increased several times.

Opto-Metric Tools Inc, 139 Varick St, New York 13, NY

MORE DATA? Circle 70, inside back cover



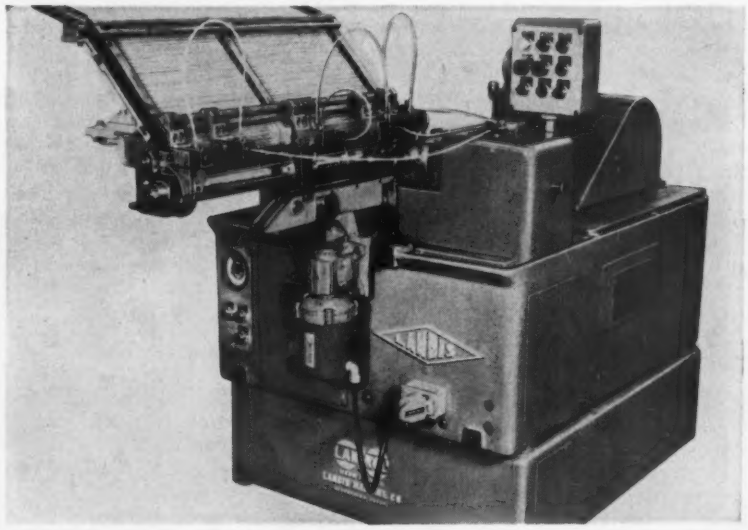
Solar Fused Quartz Panels Give Purest Radiant Long Wave Heat

Fused quartz panels, standardized in two sizes, 12 by 12 and 12 by 24 in. are said to give radiant long wave heat in its purest form. Besides the standard models any size can be manufactured for special needs. The panels consist of a completely neutral and inert surface of fused quartz which has resistance heating elements on its back. A combination of insulation prevents the radiant heat from escaping so that a one-directional radiation is achieved. The panels are equipped with bracketing for mounting.

Terminal box, cord and plug are also furnished with the standard panel which can be designed into complete radiant heating installations by the manufacturer. Heat density of installations is dependent upon the wattage and any wattage up to 550 volts can be specified. If watt density is not known the company will determine the requirements of given products or processes.

Solar Fused Quartz Radiant Heaters, 98-40 64th Ave, Forest Hills 74, NY

MORE DATA? Circle 71, inside back cover



Landis Thread Rolling and Forming Machine Does Continuous Rolling With Attachments

Continuous rolling of studs and headed parts is automatically done through the use of a feeding magazine and automatic tooling on the Lan-Nu-Rol thread rolling and forming machine.

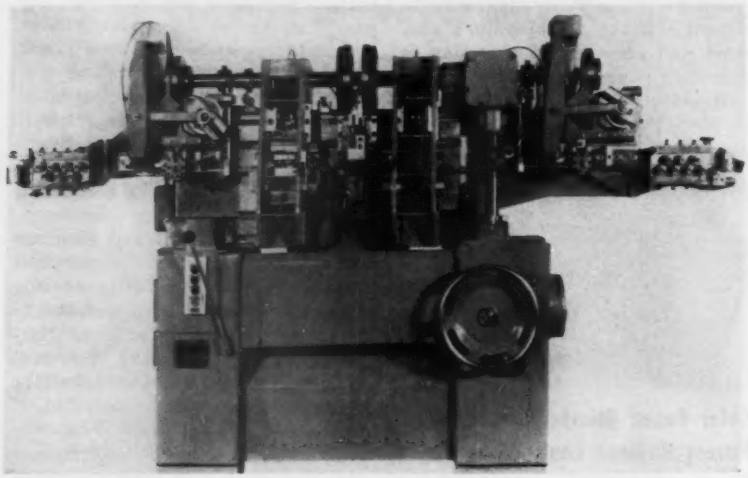
Parts up to ⅜ in. diameter having a maximum thread length and overall workpiece length of 2-1/18 and 32 in. respectively can be handled by the machine, which in this particular application was set up to roll-form automotive parts at the rate of 170 parts per minute. Thread rolling dies are substituted for the roll forming dies to switch the machine over to thread rolling.

Rods are manually loaded into the magazine and automatically indexed into rolling position where the special segmental-type dies roll-form the workpiece. After rolling, the parts are indexed out of the rolling zone and dropped onto a conveyor which delivers them into a receptacle.

The machine indexes twice to roll two parts per revolution of the two-segment die.

Landis Machine Co, Waynesboro, Pa

MORE DATA? Circle 72, inside back cover



Torrington Vertical Processing Machine Gives Output Rates up to 200 Pieces a Min

The new Double Feed V-82 vertical metal-processing machine can separately die stamp and form two wire or strip pieces and then assemble them at output rates up to 200 per minute.

Material capacity of the machine, which was derived from the company's original V-82 single-feed four-slide is 2½ in. maximum strip width, 0.062 in. maximum strip thickness, and 0.007 in. maximum wire diameter.

Maximum feed length is 12 in. with either 90 or 180-degree feed cycles and maximum press capacity is 36 tons (12 tons per press) with two presses on the left hand side and one on the right. Press stroke is 1 in., shut height is 6⅝ in., strokes of the forming slides are ⅜ in. (top and bottom), 2¼ in. (left and right sides) and ½, 1⅛, 1⅝, and 2⅛ in. on both center form and knockout.

Overall dimensions of the machine are 10 ft long, 37 in. deep, and 71 in. high.

Machine Div, The Torrington Mfg Co, Torrington, Conn

MORE DATA? Circle 73, inside back cover

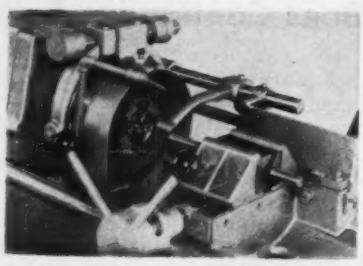
Mounting Blocks With Adjustable Wedges Level Heavy Machinery

Wedgemounts are made of adjustable cast iron wedges faced top and bottom with a pad of resilient material. With these mounts heavy machinery can be leveled in a matter of minutes simply by turning a bolt. Another feature of the mounts is the pad, called Air-Loc which has reduced shock, vibration and noise from heavy machinery 85% in tests. The cross grid embossing on these pads also prevents walking of machines yet the pad remains stiff enough to prevent rock and sway.

The mounts are available in capacities of from 500 to 8,000 lbs per unit.

Clark Cutler & Mcdermott Co, Franklin, Mass

MORE DATA? Circle 74, inside back cover



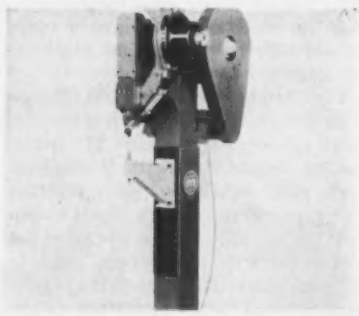
Pipe and Bolt Threading Machine Is Rotary-Head, Portable Unit

New Mercury model is designed to fill the size and production-rate gap between the very large and small equipment presently available. The machine threads ⅜-in. material at 130 rpm. It can thread ¼ to 1-½-in. bolt or ⅜ to 1-¼-in. pipe. Dies can be changed in two minutes by releasing a compression ring.

Additional features include semi-automatic trip and reset head; full ball bearing construction; knocker type chuck, and full-range vising. Adjustable automatic thread length stop ceases threading and opens vise at preset thread length. Because of its small size and light weight, the machine can be operated on any normal size working table without reinforcing or carried where ever production requirements demand.

Obear & Sons Inc, 940 W Florence Ave. Inglewood 1, Calif

MORE DATA? Circle 75, inside back cover



Milford Rivet Setting Machine Handles Rivets up to 1-in. Long

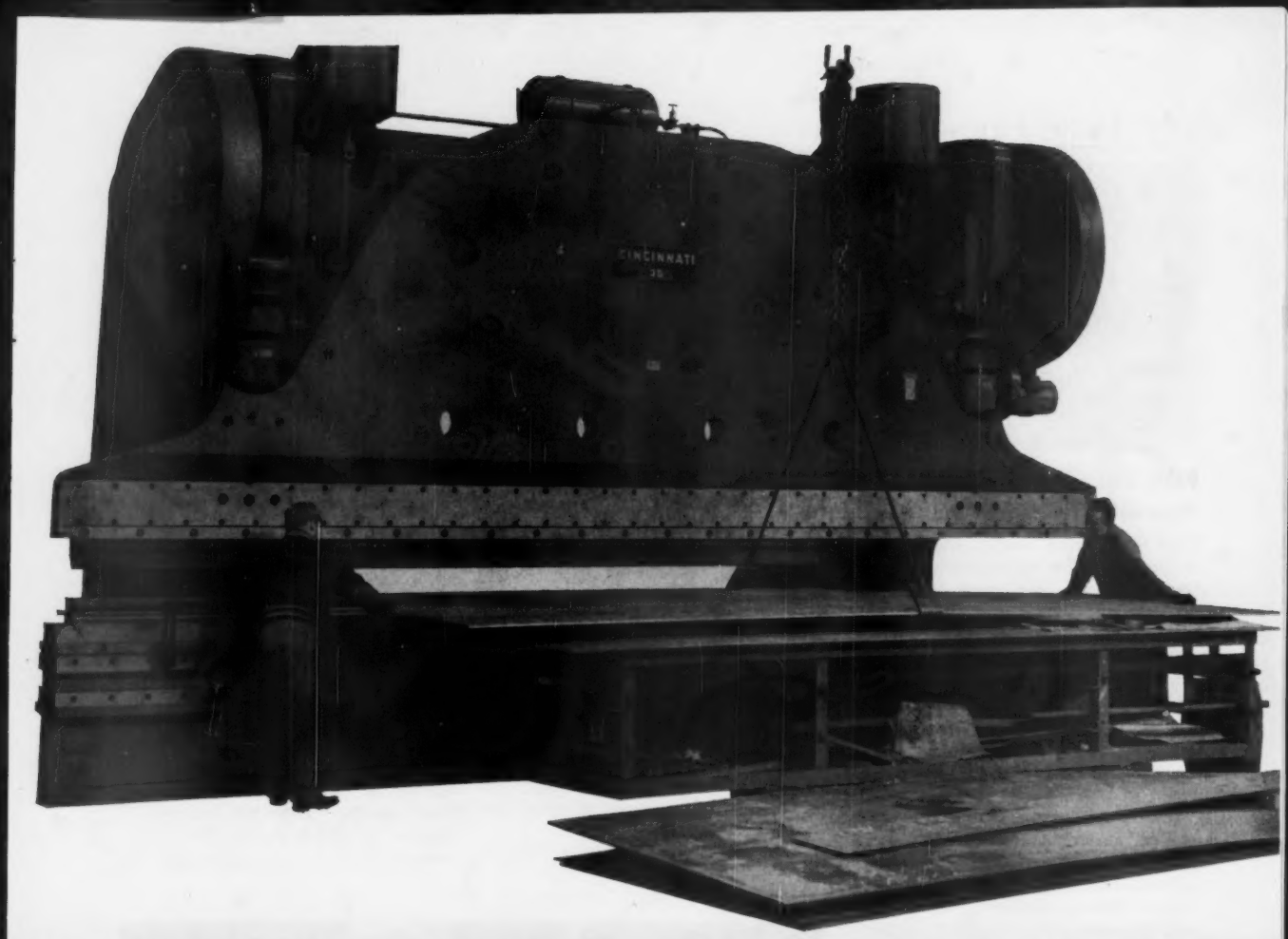
Semi-tubular rivets up to 3/16 in. diameter and 1 in. long can be handled in heavy duty, long run production by the Model 310 single spindle rivet setting machine. The stroke of 3½ in. is said to be the longest available in machines of comparable capacity and cost and allows more space for loading components and unloading riveted assemblies.

Other specifications of the Model 310 include: throat depth of 12 in., anvil height averaging 42 in., 10 in. diameter hopper, single-revolution roller clutch, crank-driven toggle setting mechanism, 165-rpm flywheel speed, 1/3-hp, 1140-rpm single-phase 110-volt ac motor.

A flexible cable has been provided on this model so that the foot trip can be located conveniently by the operator, and the rotary hopper is fitted with a handwheel so that the hopper barrel can be pulled free with a few turns for easy change-over to another rivet length.

The Milford Rivet & Machine Co, Milford, Conn

MORE DATA? Circle 76, inside back cover



CINCINNATI® PRESS BRAKE

gets new business

Bigger jobs, fewer welded seams, less handling, and easier operation—McGregor-Michigan Corporation gets all four advantages from this 36 Series Cincinnati Press Brake.

As a result, "this new brake . . . helps us be more competitive with some of the larger shops," says R. Hilprecht, sales manager of this steel plate fabricating shop.

This is another example of the way Cincinnati Press Brakes and Cincinnati Shears are reducing costs and opening up new business for shops across the country. If you don't have the new catalogs on these machines, both mechanical and hydraulic, please write for them.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

United Kingdom: The Cincinnati Shaper Co., Ltd., Glasgow, Scotland

CIRCLE 351 READER SERVICE CARD

Fillet Rolling Machine Features Pneumatic Tool Operation

This redesigned Model DER fillet-rolling machine incorporates several improvements, including all-pneumatic tool operation.

Used to roll-burnish fillets on automotive front-wheel spindles and stub shafts, the machine can process two parts at once with a yield of 240 parts an hour at 80% efficiency. Two rollers contact the work and oscillate back and forth across the fillet as they are forced against the rotating workpiece. The kneading action creates compressive stresses on the skin of the metal superimposed over tensile stresses formed in the fibers underneath. The resulting balance of controlled stresses strengthens the fillet against fatigue failure.

The Foote-Burt Co, Cleveland 8, Ohio

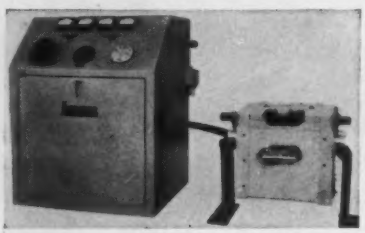
MORE DATA? Circle 77, inside back cover

Grinding Wheel Crush Rolls Added to Twin City Line

The rolls are used on grinding wheel crushers to crush-form intricate and precision shapes into grinding wheels. The company can furnish crush rolls ground to the customer's specifications and to fit any type of grinding wheel crusher. Finished and ground crush rolls can be shipped to the customer within seven days after receiving either a print or a sample workpiece.

Twin City Mfg Co, 2201 Washington Ave, N, Minneapolis 11, Minn

MORE DATA? Circle 78, inside back cover



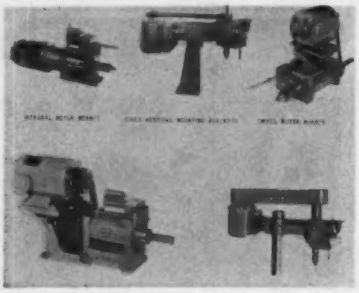
Induction Melting Unit Offered In 20-kw Self-Contained Model

Integral 20, a motor -generator powered high-frequency induction melting and heating power control unit, occupies less than 10 sq ft of floor space. Console contains everything necessary for operation of either of two induction melting furnaces or heating coils.

It incorporates a new high-output motor-generator set, capacitors, transformers, and all necessary controls and instruments. In installation, the unit is connected to a 220 or 440-v power supply, a water supply, and a water drain. Console may be mounted on casters and moved to any location.

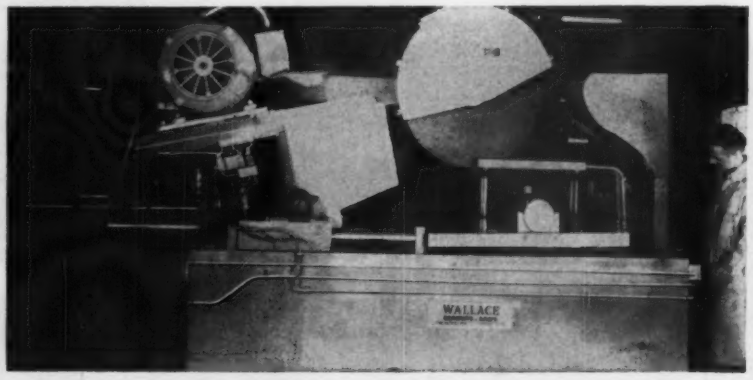
Inductotherm Corp, 10 Indel Ave, Rancocas, NJ

MORE DATA? Circle 79, inside back cover



MOUNTING BRACKETS are available in a new line to simplify installation of Hypneumat automatic drilling and tapping units—*Hypneumat Inc, 647 W Virginia St, Milwaukee 4, Wis*

MORE DATA? Circle 80, inside back cover



Wallace Cut-Machining Unit Cuts Round, Square, Steel or Alloy Solids up to 12 in.

Series 1520 cut-machining unit carries a 34-in. diameter wheel and can easily cut solids either round or square up to 12 in. in any steel or alloy now made. With special work-holding devices, bundles of 18 1½ in. rods can be cut at one time.

Speed for a 10 by 10 in. bar is 8 minutes and 20 seconds or 5 seconds per square inch. As the machine cuts it oscillates in a range of lengths up to 18 inches at an infinitely variable frequency that is controlled by air motors.

Finish produced by the 40-hp machine on the two faces or surfaces is in range of 30 to 40 micro-in. Coolant is delivered to the work through special hollowed work-holding bars at 45 gallons per minute. These bars are part of a completely self-contained coolant system.

Price of the unit shown, which is installed in a steel mill, is under $10,000.

Wallace Supplies Mfg Co, Chicago 14 Ill

MORE DATA? Circle 81, inside back cover

NOW *the SUPER-SENSITIVE* TESTMASTER

TRADE MARK REG. U. S. PAT. OFF.

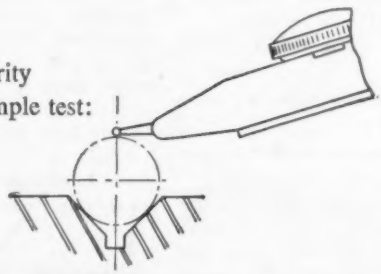
The new Federal Super-Sensitive Testmaster gives you more accurate results than any other test indicator. It's bound to . . . starting tension has been cut almost in half . . . friction has been reduced 25%, making this new Testmaster noticeably superior.

And this improved performance costs you nothing! These new Federal Testmasters sell in the regular price range ($30.00 to $32.50 including Holding Bar, Universal Clamp and Case). This new design is so inherently accurate that, for the first time, you can obtain a model graduated in 50 millionths of an inch (.000050")!

(Above)
Super-Sensitive Testmaster Model LT-V2. Large Dial. .008" range, .00005" min. grad.

(Below)
Super-Sensitive Testmaster Model T-2. Regular Dial. .008" range, .0001" min. grad. (Large Dial: Model LT-2). Metric Model also available.

PROVE this superiority with this simple test:



Support, in a V block or on centers, a part which is out-of-round in the order of .0002". Mount the new Federal T-2 or LT-2 Testmaster beside any other test indicator having .0001" grads. Then rotate part carefully and compare readings. You'll be surprised to see how much more smoothly the new Testmaster responds — how much more accurately it shows the actual variation in dimension.

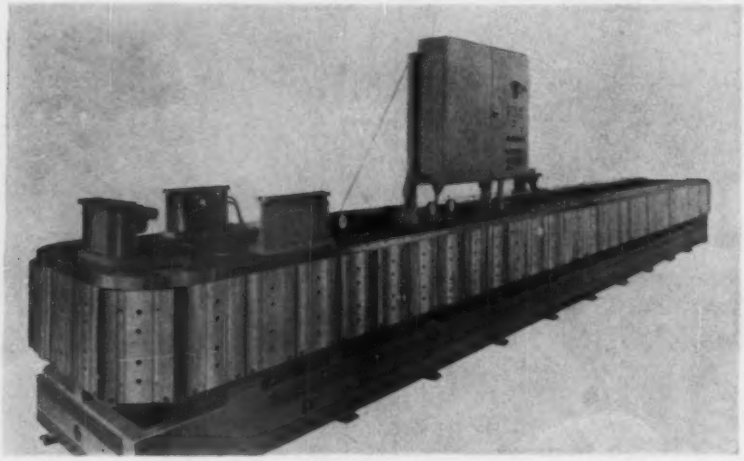
The new Super-Sensitive Testmasters (Series T) are easily identified by their Satin Chrome bezels. Regular Federal Testmaster (black bezels) are available with .001", .0005" and Metric grads.

For bulletin and further information, write

FEDERAL PRODUCTS CORPORATION
11212 EDDY STREET PROVIDENCE 1, R. I.

Ask **FEDERAL®** *First*

for recommendations in modern gages... Dial Indicating • Air • Electric or Electronic — for inspecting, measuring, sorting, or automation gaging.



Swanson-Erie Straight-Line Indexing Chassis is Built as Standardized Unit

Standardized heavy duty straight line indexing machine chassis is designed to accommodate extra-large work without sacrificing cycle time. The 30-ft long model has 70 vertical cast aluminum work carriers, each 11½ in. wide by 18 in. high with a travel of 12 in. The chassis includes an electric clutch brake for cycle control, allowing infinite adjustment of the dwell portion of the cycle, and index speeds are pre-set to customer requirements with minor adjustments possible by pulley selection and/or adjustment.

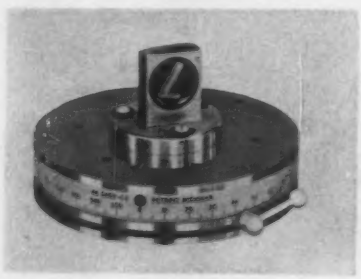
Work transfer is done by a self-contained indexing unit incorporating a hardened steel indexing cam.

An 18-in. extension of the index camshaft will accommodate tool-actuation cams, and will assure positive synchronization of tool operation with index dwell cycles. Tools may be mounted on horizontal plates above the carriers or on vertical plates below.

Carriers have jig-drilled faces, tapped for special work-holding fixtures and keyways are milled for fixture alignment and rigidity.

Swanson-Erie Corp, 814 E Eighth St, Erie, Pa

MORE DATA? Circle 82, inside back cover



360-Sided Polygon Checks Angles to ¼ Second Arc

This combination of a plane mirror and a miniature Ultradex indexing table produces a 360-sided optic mechanical polygon for checking or calibrating angles. The instrument is guaranteed accurate to ¼ second of arc total accumulated error by the manufacturer. Base of the instrument is made up of two plates each with 360 serrations that are separated when the operating handle is depressed. The top plate can then be moved through any angle and lowered onto the bottom plate. Regardless of what degree of angle is being checked, all 360 serrations engage and this patented principle allows the serrations to seat uniformly so that the instrument maintains its accuracy.

In use an autocollimator is directed to sight on a reference mirror and on the mirror of the polygon, which is clamped on the dividing head to be checked. The dividing head is rotated a specific number of degrees in one direction and the polygon mirror is rotated the same number of degrees in the other direction. The amount by which the polygon mirror does not return to its zero position is determined by sighting through the autocollimator and is a measure of the inaccuracy of the dividing head. The 5-lb polygon is priced at $2495.

AA Gage Co, 350 Fair St, Detroit 20, Mich

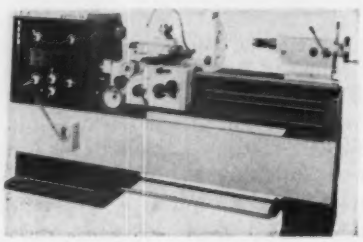
MORE DATA? Circle 83, inside back cover

Cutoff Saw Features Reduced Cutting Time

Mercury Junior Model dry electric saw reduces cutting time to seconds for 1-in. angle iron, 4 sec for 2-in. angle iron, 3 sec for 2-in. pipe, and 10 sec for 2-in. solid stainless. Top table unit pivots to allow chop stroke cutting. Cutoff wheel, fully guarded, is provided with a special spark deflector. Unit is hand operated on standard models; pedal operation is available as optional equipment. The 16-in.-dia wheel capacity and special 2750-rpm arbor shaft speed provide unusually fast cutting action and handle 4-in. tubing or 2-in. solid material.

Obear & Sons Inc, 940 W Florence Ave, Inglewood 1, Calif

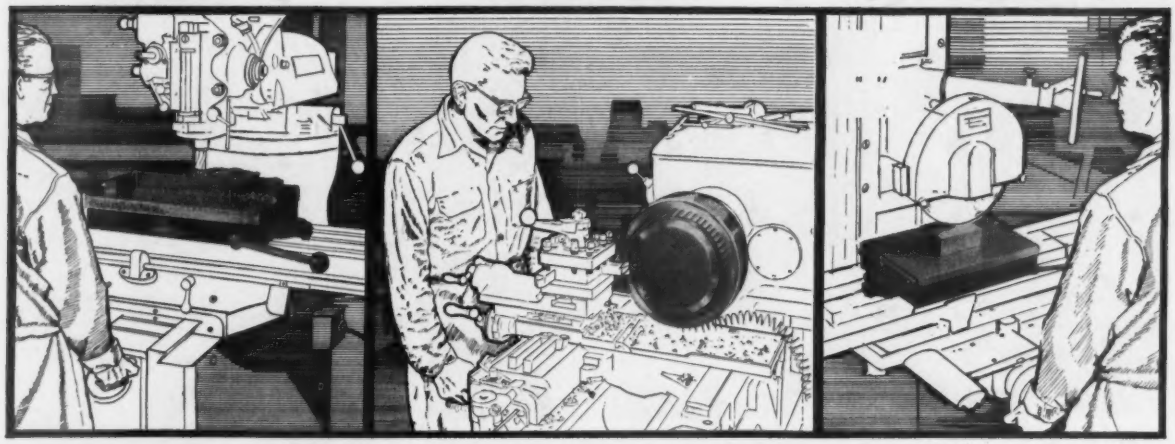
MORE DATA? Circle 84, inside back cover



SIX MODELS make up the Mondiale line of precision engine lathes which range in size from a swing of 12 to 20 in. Each model has 16 spindle speeds except the largest, the Celtic No. 20, which has 18. Top spindle speed runs from 2500 rpm on the Gallic No. 14 down to 1000 rpm on the Celtic No. 20—*Alina Corp, 112 East Second St, Mineola, NY*

MORE DATA? Circle 85, inside back cover

MILLING **TURNING** **GRINDING**



WALKER CERAMAX CHUCKS

Versatile Walker Ceramax Chucks featuring ultra-permanent ceramic magnets are successfully applied on grinders, millers, lathes, shapers and many other type machines. Powerful, rugged and stable, these permanent magnetic chucks can handle large heavy pieces or small thin stock with equal ease. The all steel top plate minimizes redressing and provides a long wearing precision work surface. Focused flux keeps the magnetism down near the top plate and away from the spindle and other machine parts. Alternating north and south poles of *equal* strength keep cutting tools demagnetized.

NEW

"COLD" OPERATING ELECTROPERM CHUCKS

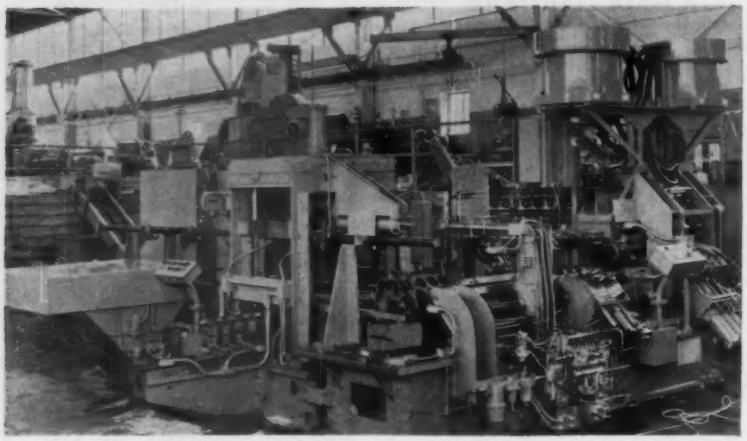
Combining the advantages of both electric and permanent magnetic chucks, this new cold operating chuck represents the ultimate in precision for large magnetic chucks. The chuck is only energized and deenergized electrically while permanent magnets do the actual holding during machinery operation. Energizing and deenergizing cycles are so short that heat and accompanying distortion are eliminated. The cold operating Electroperm Chuck is so stable dimensionally that it will hold the precision tolerances of the machine tool upon which it is mounted.

Write for Catalogue WPL60 showing the complete Walker line of demagnetizers, magnetic and vacuum chucks.

O.S. Walker

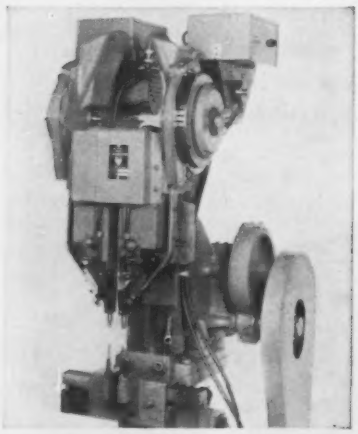
O. S. WALKER CO. INC., WORCESTER, MASS.

Original Designers & Builders of Magnetic Chucks



TANDEM PRESS INSTALLATION that allows semiautomatic assembly of cam bushings and fully automatic pressing of welsh plugs into water jacket holes of auto engine blocks also deburrs or brushes and blows out oil gallery holes, cam bushing seats and applies sealer compound. The machine progressively processes V-6 or V-8 engine blocks at the rate of 180 per hour at peak efficiency—*Detroit Broach & Machine Co, Rochester, Mich*

MORE DATA? Circle 91, inside back cover



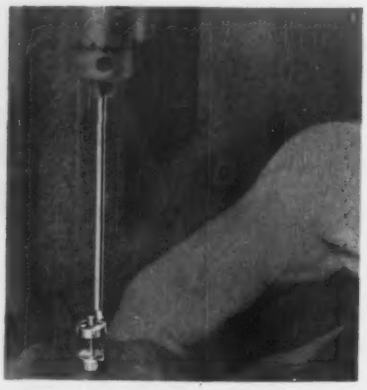
Electro-Mechanical Feed Devices Speed Automatic Rivet Setting

Series of electro-mechanical electronic rivet-feeding mechanisms reportedly will increase the speed of automatic rivet setting equipment four to five times over riveting machines using conventional feeding devices. These new controls also enable standard machines to handle a greater range of sizes and shapes than previously possible. Various machine styles utilizing these devices can feed and set extremely small rivets (0.031-in. shank dia, 0.040-in. length) as well as extra large rivets (5/16-in. shank dia, 3-in. length).

A transducer-sensing cutoff mechanism has also been developed which automatically stops the hopper rotation when required feed has been reached, minimizing tumbling and reducing rivet wear and damage. Another device eliminates jamming by automatically cutting off feeding at a predetermined point in the track.

Judson L Thomson Mfg Co, Waltham 54, Mass

MORE DATA? Circle 92, inside back cover



Tool Deburrs Backside of Small-Diameter Holes

The Burrmite will deburr the backside of holes from ⅛ down to 0.050 in. in diameter. In operation the tool enters the front side of a hole, deflects to pass its cutter through the hole, and then straightens out for the deburring operation. Withdrawal of the tool is accomplished by deflection also. Since its operation is dependent on calculated tool geometry and tool deflection the tool is limited in use to parts having uniform thickness not exceeding twice the hole diameter. In addition to deburring the backside of the hole the Burrmite also wipes or smears the front side upon entry. Speed of rotation is about 25% less than that of drill speeds for the various metals.

Cogsdill Tool Products, Inc, Oak Park, Mich

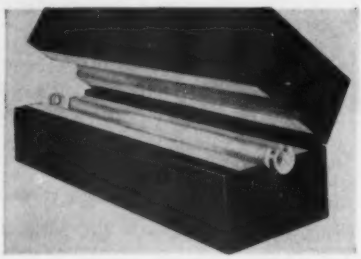
MORE DATA? Circle 93, inside back cover

Locating Support Plate Designed For Universal Drill Heads

All Johnson universal, adjustable, multi-spindle drill heads can be equipped with this new locating support plate which gives positive location of the spindles, allows no deflection when drilling, and will hold spindles in proper location when removing tools for re-sharpening. Plate can be drilled and bored by the user to meet requirements.

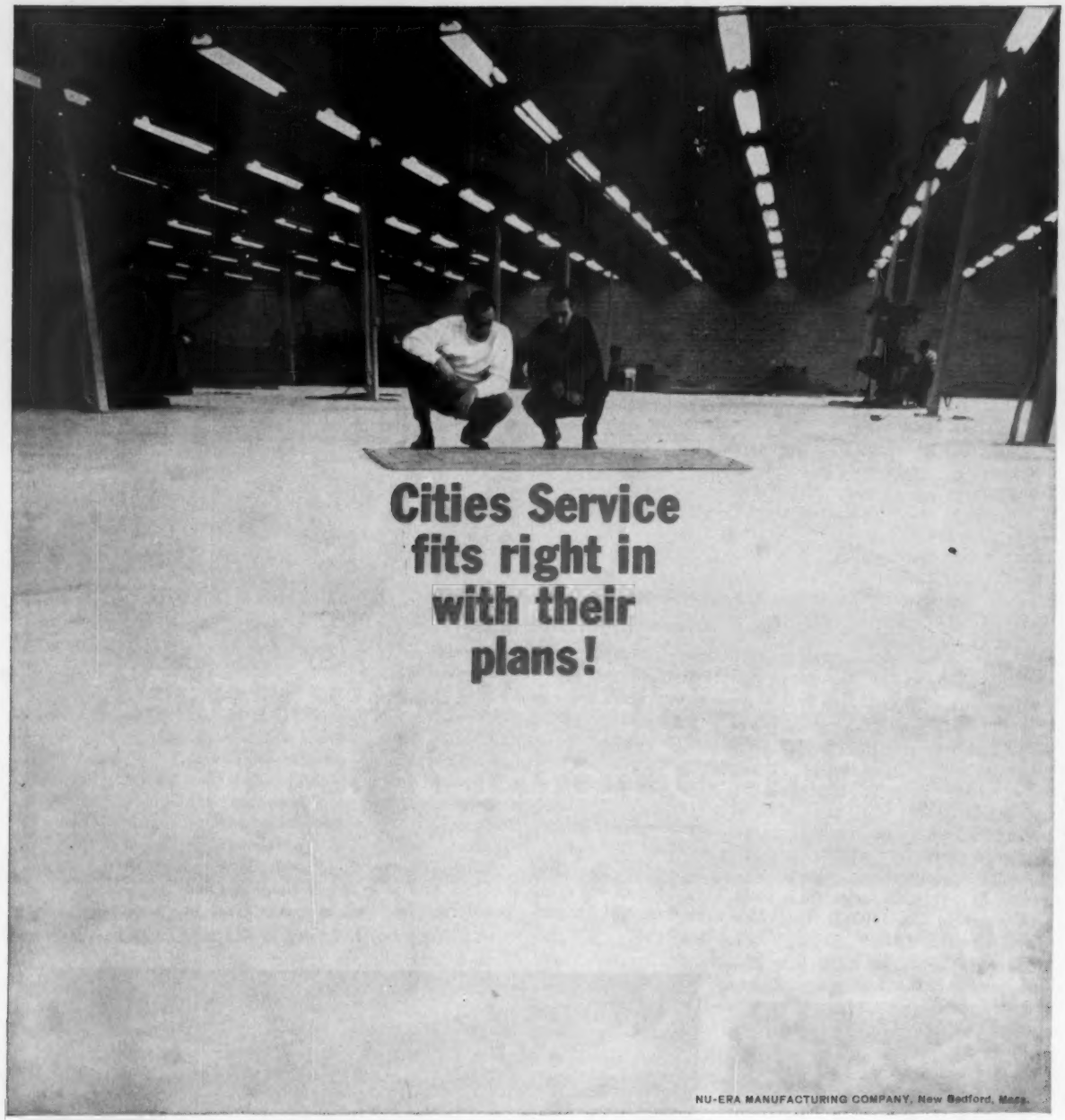
Johnson Drill Head Co, Rockford, Ill

MORE DATA? Circle 94, inside back cover



INFRARED SPLIT MUFFLE OVENS for sintering, heat treating of rods, tubing and cable, are modular; they can be extended or shortened by adding or removing modules. Heat is applied directly to the work in these ovens in which temperatures to 1500 F can be obtained—*Infra-Red Systems Inc, 240 Route 23, Riverdale, NJ*

MORE DATA? Circle 95, inside back cover



There's a bright future ahead for Nu-Era, manufacturer of replacement gears. The firm recently built this huge plant to handle increased orders... and Cities Service definitely fits in with their plans. Says General Manager Bill Rebone, "At first, all cutting oil brands seemed to be the same. However, we soon realized that Cities Service oils were giving us superior performance in every respect. Most of our gears are made of #5135 steel, a real tough customer to work with. Yet, we find we're getting long tool life, extra clean cuts with Cities Service Chillo 30 Cutting Oil." Nu-Era now relies, exclusively, on Cities Service for their metal machining fluids. Find out how Cities Service can fit in with your plans. Simply contact your nearest Cities Service office or write: Cities Service Oil Company, 60 Wall Street, N.Y. 5, N.Y.

CITIES SERVICE

Out Front in Quality... Out Front in Service, too!

NEW SHOP EQUIPMENT

Abrasive Belt Finishing Machine Handles Stock Up to 24 in. Wide

The KC (*AM*—July 13 '59, p146) flat surface finishing machine is available in three basic sizes for handling parts from 8 to 24 in. wide. Equipped with a conveyor belt feed, it will finish parts made of metal, plastic, ceramics, wood, or rubber. Tandem arrangements can be made using as many units as necessary to produce the required successive grit finish. When used in tandem for applications requiring two side finishing operations, an automatic part turnover mechanism can be incorporated in the line.

Model KC-24-in., illustrated, performs high-production finishing of miscellaneous shaped parts. It has an abrasive belt 24 in. wide by 138 in. long and will handle stock up to 8 in. thick. Abrasive belt speeds can be arranged to suit the specific finishing requirement. Work feed range is available with 3:1 ratio.

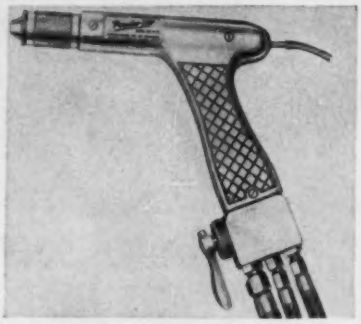
Acme Mfg Co, 1400 E Nine Mile Rd, Detroit 20, Mich

MORE DATA? Circle 86, inside back cover

is equipped for 90° indexing but any number of indexing stations can be added either by the company or the customer. Turrets are available in sizes 2½, 3½, and 4-in. sq with three different types of mountings.

Polivar Mfg Co, PO Box 19405 Houston 24, Texas

MORE DATA? Circle 87, inside back cover



Combination Powder-Jet Units Offered by Metallizing Co

New models of powder metals and ceramic spraying equipment are designed for increased hard facing speeds. Model AL-205 is capable of depositing such ceramics as Zirconia and Aluminia at greater spraying speeds, with higher deposit efficiency, resulting in harder and more impervious coatings.

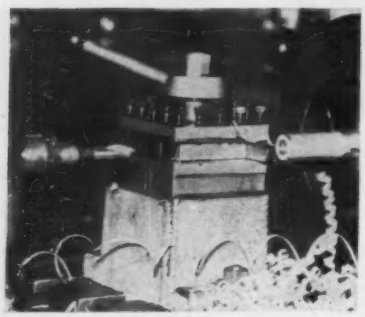
Model CA-305 sprays up to 16 lb per hr of hard-facing alloys and is capable of spraying a broad line of commercial metal powders. Improved bonding techniques are used in this process.

Metallizing Co of America Inc, 3520 W Carroll Ave, Chicago 24, Ill

MORE DATA? Circle 88, inside back cover

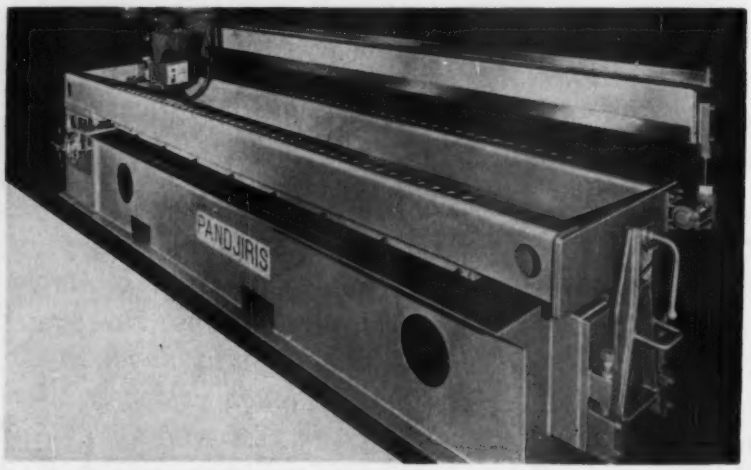
OHIO DM MAGNETS, aluminum-wound, and of welded construction, are available in 39, 46, 56, 61, and 71-in.-diameter sizes. Coil is wound with anodized aluminum for 75% duty cycle. Magnet is supplied with a cast manganese steel suspension chain—*Ohio Electric Mfg Co, Subsd of Howell Electric Motors Co, 5400 Dunham Rd, Maple Heights, Ohio*

MORE DATA? Circle 89, inside back cover



Self-Indexing Turret Toolpost Has 0.000075-in. Accuracy

Tools are guaranteed to an indexing accuracy of 75 millionths of an inch. All components subject to wear are case hardened, ground and lapped or honed to a 4-micro-in. finish. Block is fully supported by its base, minimizing tool overhang, and can be locked in any position. The turret



FLAT SEAM WELDING SEAMER will automatically seam available widths of steel, stainless, aluminum or nickel alloy into large sheets. Distortion is avoided by clamping the edges to be welded against a machined water-cooled back-up with or without inert gas. The water cooled clamping allows 100% penetration and high quality welding from the top side—*Pandjiris Weldment Co, 5151 Northrup Ave, St Louis 10, Mo*

MORE DATA? Circle 90, inside back cover

Why hammer the spindle of a Hamilton Gage?

To prove that Hamilton Gages are built to take it. (You can drop a Hamilton Gage on its spindle and it still maintains its accuracy.) The reason: a unique, indirect transmission action from spindle to gear mechanism. Pressure at the spindle end *releases* the movement for operation rather than driving it. As a result, any shock at this point cannot force the gear mechanism . . . and *you* cut replacement costs.

More reasons why you can depend on Hamilton Gages? Hamilton's offer of a complete movement replacement for a nominal charge. Hamilton's gage repeatability to .00001". Hamilton's light gaging force (2 or 4 ounce) that's adjustable. Hamilton's years of watchmaking experience, so valuable in maintaining the fine accuracy of precision gages. Hamilton's complete line of mechanical and electric gages for post-process inspection or in-process production control.

For free data sheets on Hamilton Gages, write to Dept. 2212, Hamilton Watch Co., Lancaster, Pa. They give full specifications on most items in our line. Or, if you have a special gaging problem, write directly to E. P. Barber, Director of Industrial Products Division.

Kwik-Chek Gages—another precision product of the

HAMILTON WATCH COMPANY

Industrial Products Division, Lancaster, Penna.

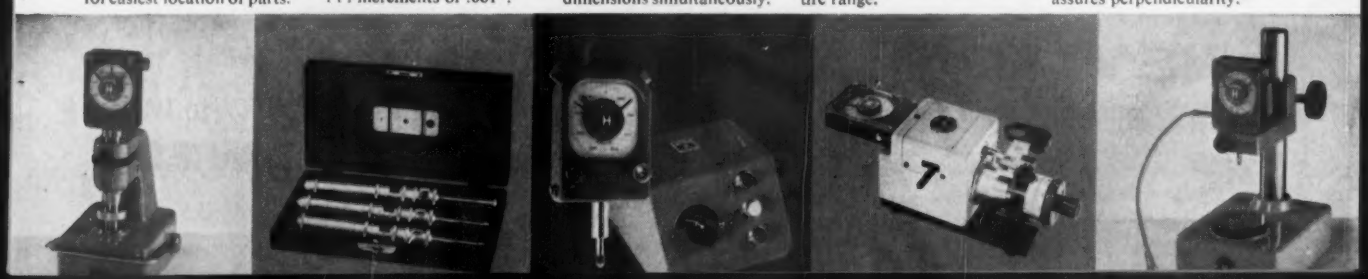
HAMILTON RECESS DEPTH GAGE for production gaging of recesses. Comes with both tiltable and rigid table for easiest location of parts.

HAMILTON HOLE GAGES replace as many as 700 plug gages. Precision accuracy in range from .025" to .380" . . . increments of .001".

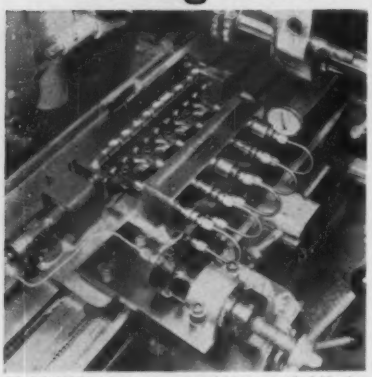
HAMILTON ELECTRIC GAGING SYSTEMS for in-process control. Lights indicate several out-of-tolerance dimensions simultaneously.

HAMILTON HORIZONTAL INDICATING MICROMETER GAGE for absolute measurements. Accurate to .00005" over entire range.

HAMILTON PRECISION DIAL COMPARATOR for applications requiring ultimate in precision. Fine adjustment assures perpendicularity.



Hydraulic Clamping SLASHES Loading Time



Six NEWTON clamps secure cartridge-mounted blocks of tough alloy material during milling operations.

PRODUCTION INCREASED AND QUALITY IMPROVED

. . . with the use of this Newton Hydraulic Clamping fixture. After only a short time in production, these advantages were noted:

- **Positive, repeatable, equal clamping with no distortion**
- **No adjustments required for workpiece irregularities**
- **Better machine utilization**
- **All clamping and unclamping done rapidly with a single motion**

LOW COST OF NEWTON HYDRAULIC UNITS

. . . makes the use of this type of clamping desirable from both economy and design standpoints; all parts of the hydraulic units are reusable for building other fixtures.

For fast cycling operations use Newton hydro-pneumatic intensifiers.

A Newton engineer will be happy to advise you on the type of equipment best suited to your needs. Fill in the coupon below.

I'd like more information on speeding up production with NEWTON HYDRAULIC CLAMPING SYSTEMS.

☐ Send literature
☐ Have representative call

Name & Title_____

Company_____

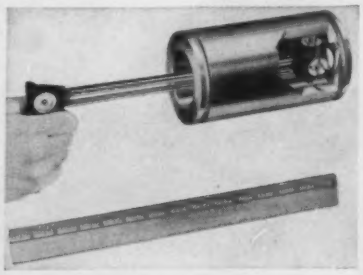
Address_____

City_____

State_____

NEWTON

HYDRAULIC TOOLING CO., INC.
AUBURN, MASSACHUSETTS



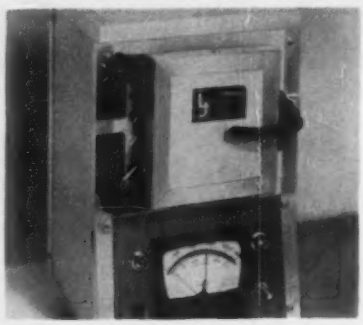
New Snap-Plug Gage Developed For Deep or Long Hole Jobs

Snap-Plug adjustable internal gage for checking size, taper, and out-of-roundness, is available as Model 2100 with range of 1 to 2 in., and Model 2200 with 2 to 4-in. range. One insertion checks undersize, in-size, or oversize conditions; any depth of check is possible with this single insertion.

Linkage bars are stocked in 12, 18, and 24-in. lengths. Bars are interchangeable on basic Model 2200 head and handle; special length bars are available at a nominal charge. Complete kit contains checking head, handle, twin actuator bars, 16 gage pins, micrometer type centralizing gage, and adjustment wrenches.

Southern Gage Co, Erin, Tenn

MORE DATA? Circle 104, inside back cover



Portable Furnace Reaches 2200 F In Less Than 10 Minutes

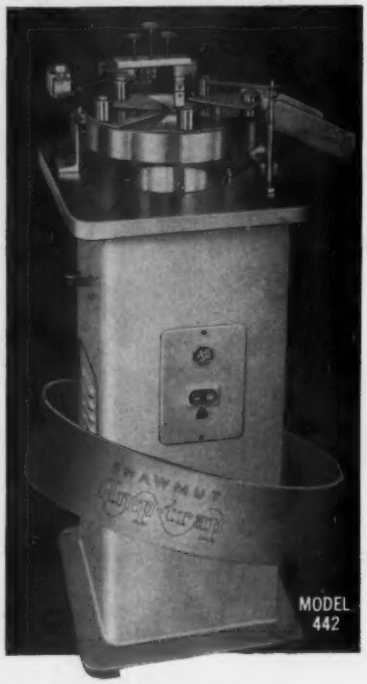
Lightweight unit achieves 2200 F from room temperatures in under 10 minutes, Because of improved insulation techniques it is reported to provide a very accurate temperature control. It employs meter-relay pyrometer controllers and temperature is easily adjusted with a single knob.

The cycled heating power is controlled by solid state switch which insures low electrical noise and reliability. Standard sizes range from approximately 64 to 500 cu in.

L J Products, 7464 Girard Ave, La Jolla, Calif

MORE DATA? Circle 105, inside back cover

LOWER COSTS with rapid production MARKING MACHINES



Noblewest dial-type rapid production marking machines meet industry's needs for higher marking speeds at lower costs. Available in many models and sizes, they will *permanently Roll-Mark* the O.D. of cylindrical and conical shaped parts up to 12,000 pieces per hour.

Write for specifications.

NOBLE & WESTBROOK MANUFACTURING CO.
17 Westbrook St., East Hartford 8, Conn.

Production marking requires fine dies of Noblewest quality. Competitively priced.

mark it best with
NOBLEWEST

ACCURACY AND GRIP...

When you buy new tools or rebuild old ones

START UP FRONT

- Precisely the point where the tool does its work.
- Precisely the point where profits are made and lost.
- Precisely the point where the accuracy and grip of Jacobs Chucks reduce tool breakage, downtime and rejects.

This is precisely the point, start up front with Jacobs.

Finest machinists everywhere know the Jacobs Plain Bearing Chuck as standard equipment for portable power tools. They know it for *precision accuracy* and *powerful grip* . . . the most widely used chuck in the world.

INDUSTRIAL TEAMWORK

Your industrial supply distributor knows your business. He is always ready to fill your needs quickly and economically. When you need chucks you can depend on this industrial team—Jacobs and your Jacobs industrial supply distributor.

Jacobs
CHUCKS

THE JACOBS MANUFACTURING COMPANY,
WEST HARTFORD, CONNECTICUT

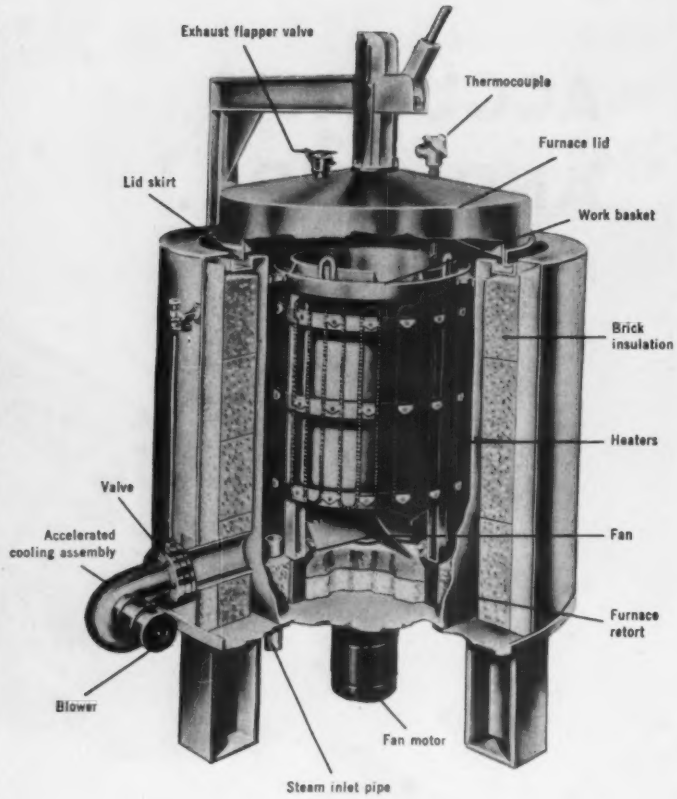
IS STEAM TREATING AN UNKNOWN QUANTITY TO YOU?

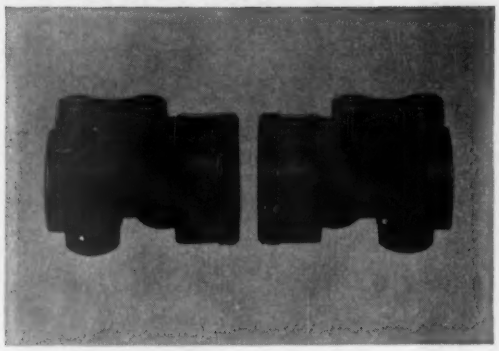
If you work with metal . . . ferrous or non-ferrous . . . and haven't considered steam atmosphere heat treating for your product, you may find you've overlooked an unsuspected source of surprisingly substantial savings.

On the opposite page are just four examples to illustrate our point. If you want others . . . or details on any of these . . . or want us to help investigate possible savings you can make, just phone your nearest L&N office or write us at 4946 Stenton Ave., Phila. 44, Pa. Catalog TD2-620(1) tells all about it, too; we'll be glad to send you a copy.

LEEDS & NORTHRUP

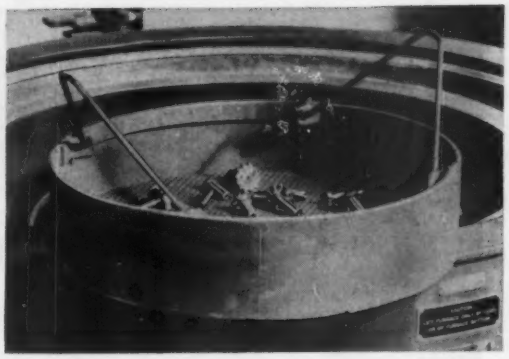
Pioneers in Precision





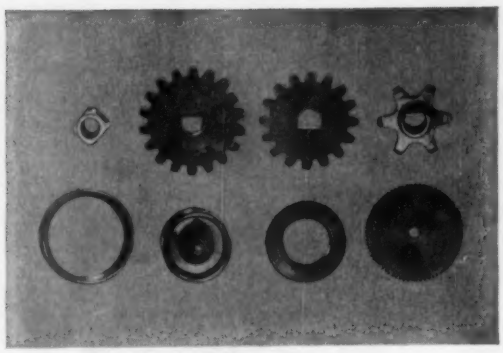
REPLACES CADMIUM PLATING . . . These grey cast iron valve bodies are used in the pneumatically operated sanders that deliver sand for improved traction under the wheels of trains, trolleys and trucks. Their manufacturer had a double-barreled problem . . . porosity in the castings was causing excessive rejects . . . expensive cadmium plating was necessary to prevent corrosion in service.

Steam treating has solved both problems in one operation. Rejects due to porosity have been eliminated, and many valves previously rejected have been salvaged. Cadmium plating has been eliminated entirely because exhaustive salt spray tests showed the steam-treated finish had a higher resistance to corrosion.



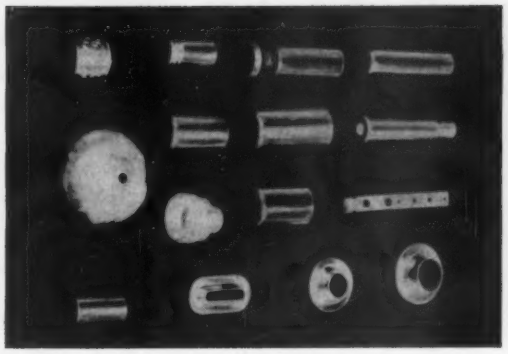
PUTS "EXTRA-LIFE" IN CUTTING TOOLS... A machinery manufacturer faced a tough problem when specifications called for milling a 0.250-inch-wide key-way slot into a piece of 4140 cold-rolled bar stock which was heat treated to a hardness of Rc 34 to 38. In addition, tolerances were tight . . . ±0.001 inch . . . with sides perfectly square.

The first high-speed steel tools used produced only four cuts and could not be resharpened because of the close tolerance. Hard-chroming the same tools improved cutter life to about 11 pieces per tool. Carbide tools held up for from 11 to 14 pieces. The next move was steam treating experimental batches of tools in an L&N furnace. The first batch averaged 100 parts per cutter, a second batch, 60 to 70 and a third lot, 100 to 125.



RAISES "PSI" OF POWDERED IRON PARTS... Although many parts made of powdered iron function satisfactorily in the as-sintered condition, there are others where an increase in hardness and compressive strength is an advantage.

This is particularly true of such parts as the steam-treated gears, cams, etc., shown above, where additional strength is needed on critical bearing surfaces. The shock-absorber piston in the center, for instance, presented a real problem . . . how to meet psi specifications for the thin-section flange around the outer edge. Steam treating proved a cheap, practical solution. Tests showed compressive strength of the flange increased from 1200 to 1400 psi. In addition, the parts, when oil dipped, had a pleasing uniform, blue-black color and high corrosion resistance.



CUTS EXPENSIVE PICKLING COSTS . . . Non-ferrous lipstick tubes and other cosmetic containers made by a large Canadian manufacturer must be annealed before finishing operations can be performed. Scale was a problem. If left on, it ruined tools and dies . . . removing it meant expensive, messy pickling.

The solution was found when sample parts were annealed by the steam Homo® method. When this method was adopted as an integral part of the production line, pickling was eliminated. Subsequent figures from the cost-accounting department showed that eliminating this operation reduced annealing cost by 53 percent.

LEEDS & NORTHRUP *Pioneers in Precision*

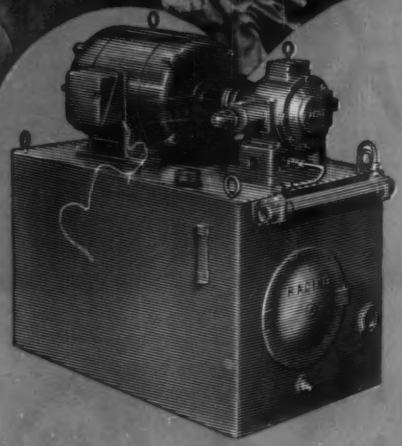
CIRCLE 359 READER SERVICE CARD

SELF-CONTAINED J.I.C. POWER UNITS SERVING UNIVERSAL SPIDER TRANSFER MACHINE BUILT BY DRILLUNIT, INC., DETROIT

Six hydraulic hearts

FURNISH MUSCLE FOR 5 TRANSFER OPERATIONS . . . WITHOUT A PALLET

"This is the first time that a spider for a universal joint has been machined in direct transfer of the part itself rather than by pallet transfer," says William Defibaugh, Vice President and Chief Engineer of Drillunit, Inc. The new unit is only half the size of any previous spider transfer machine. Clamping and unclamping the spider are governed by 5 RACINE Model 4FA Pumps, each one a self-contained power unit with its own reservoir. A sixth 4FA unit controls movements which turn, probe and transfer the part from station to station. To complete the hydraulic package, 24 RACINE Model Q Pumps serve the standard self-contained drill units. R. S. Naeyaert, President, adds, "RACINE flexibility in delivering pressurized oil in *variable volume* at *varying pressures* make it the ideal choice."



The HEARTS of this automotive transfer operation are the compact RACINE *Power Units equipped with*

MODEL 4FA
VARIABLE VOLUME
VANE-TYPE PUMPS

RACINE

Racine Hydraulics & Machinery, Inc.
RACINE, WISCONSIN
HYDRAULICS DIVISION

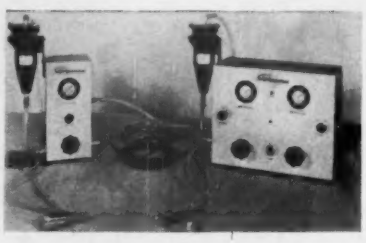
4-Stage Automatic Cleaner Is Ultrasonic/Mechanical Unit

The Monar-Matic, for small parts cleaning, takes parts through a cleaning cycle, two rinses, and a drying cycle automatically, and shuts itself off when the job is finished. Operator can set any one or all of the four operating cycles to run from 1½ to 9 minutes, depending upon the particular cleaning requirement. Once these time cycles have been set, by means of a dial, the operator loads the basket (8 in. dia x 5 in. deep) and turns on the switch.

The basic machine for mechanical/chemical cleaning is equipped with three stainless steel tanks. It can be additionally equipped with an utrasonic generator and transducerized tanks. Line of cleaning chemicals available includes both mechanical cleaning solutions and mechanical/ultrasonic solutions.

L & R Mfg Co, 577 Elm St, Kearny, NJ

MORE DATA? Circle 106, inside back cover



Twin Automatic Applicator Designed for Soldering Lines

Paste solder applicator can make two deposits of Fusion paste solders or paste brazing alloys at the same time, doubling the amount of material applied or the speed with which automatic soldering lines can operate.

The Fusion paste method automatically applies solder or braze alloy and flux (in paste form) to the parts to be processed while they are on

the soldering line. This, in combination with automatic conveying and heating equipment, completes the soldering or brazing cycle, making it fully automatic.

Applicator uses the electrical circuit and one air circuit in both units; each has an individual gun and paste storage tank. Units can be individually controlled for amount of deposit and, in special situations, can cycle independently.

Fusion Engrg, 17921 Roseland Ave, Cleveland 12, Ohio

MORE DATA? Circle 107, inside back cover

Winslow Gaging Systems Give Readouts From 24 Different Places

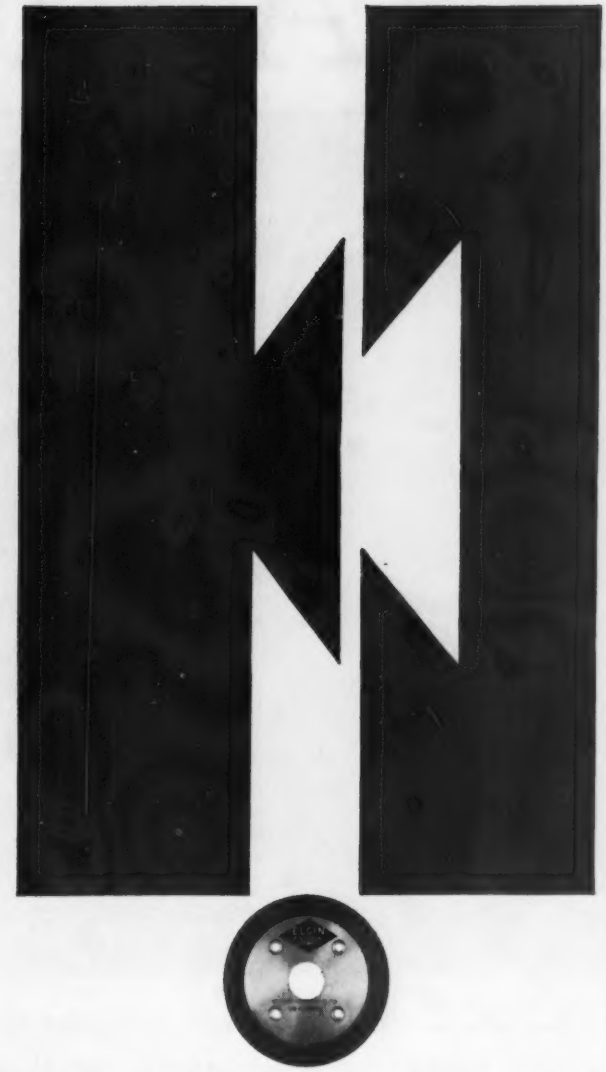
Consoles for these gaging systems show the gage location on a variation from a nominal part dimension for as many as 24 different gages. The information from the probes is displayed in lighted numerals 1 in. high and is also printed on paper tape. The probes are ⅜-in. diameter by 2 13/32-in. long and have flexible connecting wires to allow check points in difficult-to-reach places. They are especially recommended for gaging the interior of hollow parts since no view of the probe is required.

The console will read the probes individually if the proper button is pressed or in sequence, automatically. Variations in nominal part thickness may be read between any two opposed probes.

Accuracy of the system with careful setups is 0.0001 in. and the average operator under shop conditions can be expected to get accuracies of 0.0002 easily, according to the manufacturer.

Winslow Mfg Co, 1751 E 23 St, Cleveland 14, Ohio

MORE DATA? Circle 108, inside back cover



FOR CRITICAL TOLERANCES AND PRECISION GRINDING

SPECIFY ELGIN DIAMOND WHEELS

Don't risk expensive piece parts of exotic metals or ceramics with a "good enough" diamond wheel! Insist on Elgin Diamond Wheels for top performance based on uncompromising production standards and guaranteed diamond content.

Let Elgin study your next critical grinding job. They will help you select the right grit, wheel-shape and bond to assure maximum efficiency, highest quality finish and long wheel life!

Call your local Elgin distributor, or write for catalog.

ABRASIVES ELGIN DIVISION

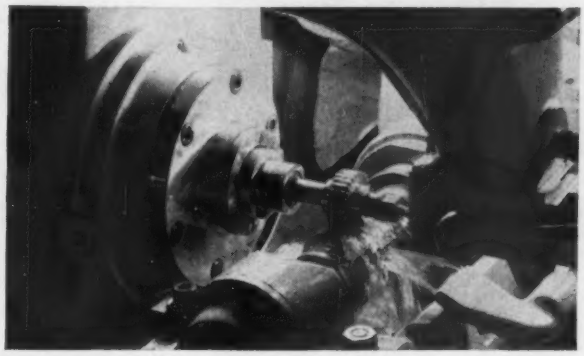
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

$24,000 ANNUAL

TOTAL JOB ANALYSIS *multiplies savings over conventional cost studies*

Charles Bruning Company, well-known maker of copying machines and engineering instruments, can now put an additional $2,000 per month into product quality without charging their customers an extra nickel! Part of the reason is the MULTICYCLE version of the No. 16-16 hobbing machine. The machine is so simple and automatic that the operator has time to check his own work. Bruning, in effect, gets 100% inspection free. Savings are the result of objective analysis of the total job, and total cost. The hob is as important to the outcome as the machine. The 16 D.P. gear (shown) measures only 1.875" on the OD. But on the No. 16-16 it can be hobbed with a 3 1/2" diam. triple-thread hob. This increases index speed.

Speed is only part of the cost determination. Lowest total cost was Bruning's objective. Reduction of hob approach distance and noncutting time was their answer. Power vertical feed . . . rapid traverse of the workslide and hob carriage . . . and automatic control are three ways to minimize total cycle time. This is the MULTICYCLE concept. Result is conclusive. The right hobs and a modern machine are producing an annual net return of $24,000. ■ Are your costs pegged high by tradition? A new MULTICYCLE machine often pays for itself as a straight replacement. Choice of three preselect automatic cycles gives you complete general-

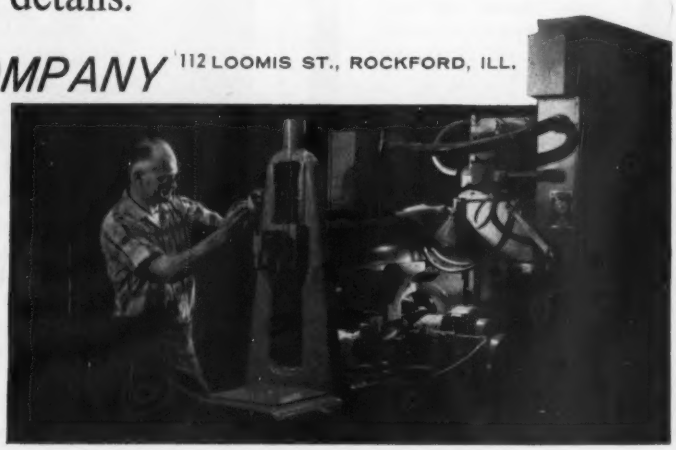


SAVING

purpose flexibility. Both setup and cycle time are reduced. ■ Take advantage of a Barber-Colman total job analysis. A complete cost evaluation . . . developed from your gear prints and production requirements . . . can be backed by a job simulation for your inspection in our TEST CENTER. Phone your Barber-Colman representative for details.

BARBER-COLMAN COMPANY 112 LOOMIS ST., ROCKFORD, ILL.

BARBER COLMAN



Operator checks his own work while the machine is cutting. Side benefit is free 100% inspection.

The Most For Your "Rockwell Testing" Dollar!

GUARANTEED ACCURATE

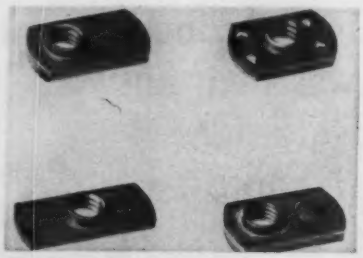
CLARK HARDNESS TESTERS ARE *GUARANTEED* ACCURATE FOR ALL "ROCKWELL TESTING". CLARK'S EXACTING WORKMANSHIP IN THE PRODUCTION OF PENETRATORS, TESTING BLOCKS, ANVILS, AND OTHER ACCESSORIES PAYS OFF IN EXCEPTIONAL ACCURACY ON THE JOB. NO WONDER THE LOW COST SURPRISES OUR FIRST-TIME CUSTOMERS. *CLARK INSTRUMENT, INC., 10201 FORD ROAD, DEARBORN, MICHIGAN.*

FREE REFERENCE BOOK

Description and prices for Clark Hardness Tester and free Hardness Conversion Chart available on request.

Missile-Age Accuracy

CLARK INSTRUMENT, INC.
10201 FORD ROAD
DEARBORN, MICHIGAN



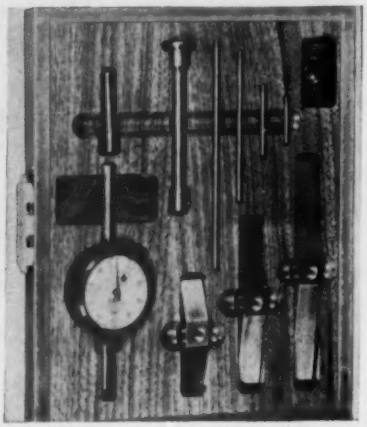
Gripco Tab Weld Nuts Eliminate Locating Devices

Two new types are introduced. The Spotweld type is available in two configurations. S1 features a self-locating pilot for fast feeding and welding. It has a single spotwe'd area at one end with threads at the opposite end of the nut and is designed for applications where space limitations are a factor. The S2 which adds strength to the area to which the nut is welded, requires a double spot weld, with threads located in the center of the nut. No re-tapping is required because of the location of the pilot in relation to the spotweld area.

Second type is the Pilot Projection. The P1 has a single-weld projection and the P2 a four-weld projection. Both can be welded to a variety of metal thicknesses and weld settings, utilizing minimum current and short time cycles.

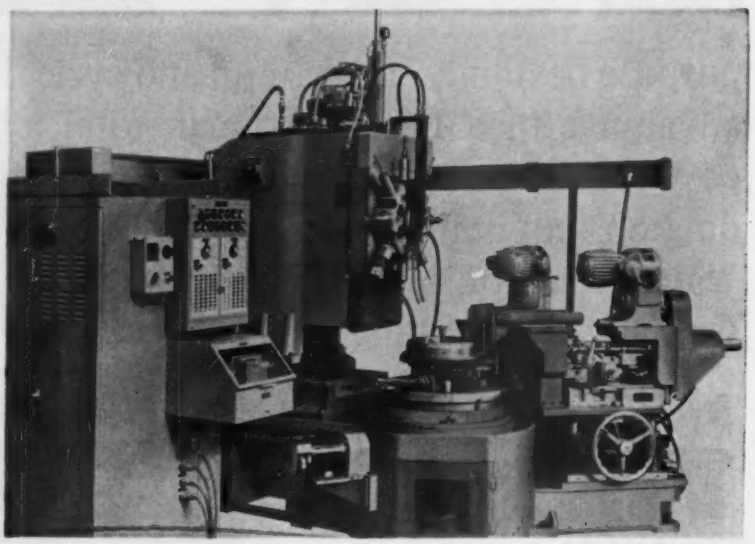
Grip Nut Co, South Whitley, Ind

MORE DATA? Circle 109, inside back cover



THE UNIVERSAL DEPTH comparator makes possible inspection of many types of machined internal grooves, shoulders and counterbores. The basic set consists of: 3 bases of different sizes, 1 sub-base for checking from one internal surface to another, 4 extension rods, 2 extension supports, 4 contact discs and 1 special indicator.—*The Lad Gage Co, Geauga Lake Rd, Aurora, Ohio*

MORE DATA? Circle 110, inside back cover



8-SPINDLE AUTOMATIC TURRET-DEX HEAD mounted on a movable slide that has a 12-in. movement in and out over a rotary 30 in. automatic tape controlled index table gives infinite indexing on this multiple spindle turret machine tool used for drilling flywheel parts for diesel engines. Automatic control of the machine through a GE system includes rotary table position, turret indexing, column in and out movement, coolant off and on, 12 spindle speeds, 15 feed rates, and control of two Aveydraulic side heads—*Avey Division of The Motch & Merryweather Machinery Co, Cincinnati 1, Ohio*

MORE DATA? Circle 111, inside back cover

Now, any soluble coolant from one source...SUNOCO

SUNOCO

QUALITY...

THE BEST ECONOMY OF ALL

Sun is literally a supermarket for soluble oils—all the way from a low-cost emulsifying oil to a chemical coolant. Each one can solve a different production problem. For example:

For *versatility* at moderate cost, use regular S.E.C.O. (Sunoco Emulsifying Cutting Oil).

For *heavy-duty work*, use S.E.C.O. HD.

For *high detergency*, machine or grind with S.E.C.O. 271.

For *high-power wetting and lubricity*, use Sun's new chemical coolant, Sunicool.

Check into Sun Soluble Cutting Oils now. They've led the field for years . . . they're backed by Sun Oil . . . they're good. Ask your Sun Representative for details. Or write to SUN OIL COMPANY, Dept. AM-12, Philadelphia 3, Pa. In Canada: Sun Oil Company Limited, Toronto and Montreal.

FREE! Your choice of these cutting oil helps. Write today.

1. 2-page fact sheet—"Uses & Advantages of S.E.C.O."
2. 2-page data sheet—"Heavy Duty S.E.C.O."
3. Plastic Chart—"Emulsion Mixing Instructions"
4. 2-page guide—"Disposal of Waste Cutting Oil Emulsions"
5. 84-page book—"Cutting and Grinding Facts"

SOME CUES FOR THE ACTIVE COST-REDUCER

This PLANNER is for the man who doesn't have time to waste determining whether a supplier can help him produce at less cost. If you're this type of active cost-reducer, we know we're welcome. It takes only five minutes to go through this PLANNER and not much longer to get us started on any project it may suggest. Like to have our man in your area call? Please contact Emhart Manufacturing Company, Hudson Division, Hudson, N. Y.

EMHART

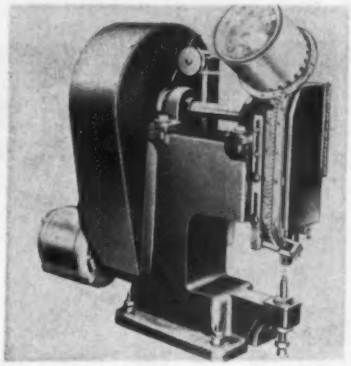
COST REDUCTION IN SMALL PARTS PRODUCTION

This is our business — and to prove it, we'd like to go over at least sixteen areas in which we've had good, hard practical experience. Here they are:

1. PRODUCT DESIGN
2. MATERIAL AND PARTS FLOW
3. PACKAGING
4. FABRICATION
5. ASSEMBLY
6. DIRECT LABOR
7. INDIRECT LABOR
8. METHODS SIMPLIFICATION (People)
9. METHODS SIMPLIFICATION (Machines)
10. QUALITY CONTROL
11. IN-PROCESS INVENTORY
12. MAINTENANCE
13. FLOOR SPACE
14. SPARE PARTS INVENTORY (Customer)
15. SPARE PARTS INVENTORY (V & O Machines)
16. CRITICAL OPERATIONS

V & O AUTOMATIC PRESSES AND FEEDS

CIRCLE 367 READER SERVICE CARD



Rivet Machine Handles Various Lengths Without Tooling Change

New Etco 600 tubular rivet machine handles all makes of rivets from the smallest to ⅛-in. dia and from 1/16 to ½-in. long. No change in tooling is necessary when changing from fasteners of one length to another as long as the barrel diameters are the same. Fasteners with different barrel diameters require only changing of the feed tracks.

A setting force of more than 3,000 ft lbs is produced through the 40-lb flywheel which is engaged by a single-revolution clutch operated by an electric foot switch. The circuit is designed to prevent double strokes.

In addition to rivets the Etco 600 will handle all makes of eyelets and grommets.

Eyelet Tool Co, Inc, Cambridge, Mass

MORE DATA? Circle 112, inside back cover

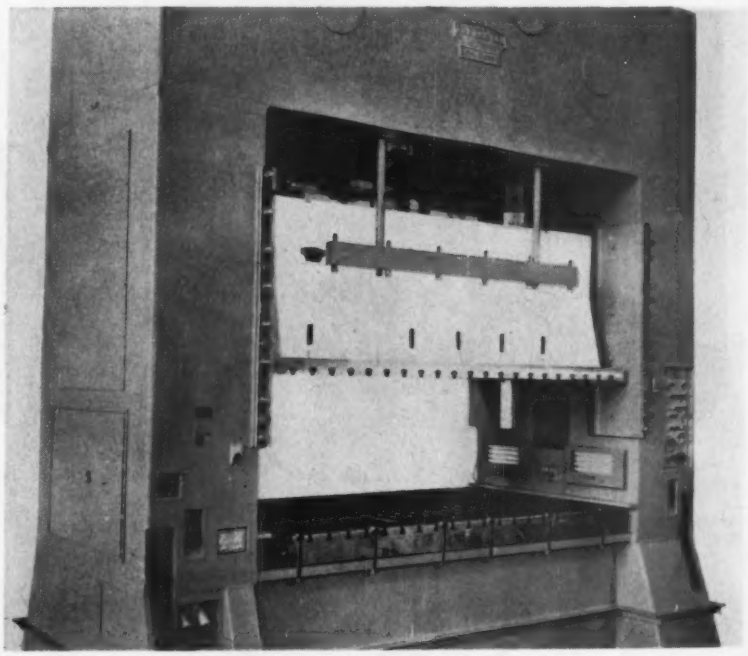
Ultrasonic Cleaner Introduced In 5-gal-Capacity Model

The diSONtegrator System 320 has a 5-gal-capacity cleaning tank with working compartment measuring 14 in. long x 12 in. wide x 10 in. deep. A 12-in.-deep tank is also available. Unit, guaranteed for five years, features broad band frequency modulation which eliminates need for automatic tuning and prevents overloading of transducers.

Generator is rated at 320 w average power, 1280 w peak power output. Fused for 7 amp, it operates from 117-v 50/60-c line current. Price is $499.95.

Ultrasonic Industries Inc, Engineers Hill, Plainview, LI, NY

MORE DATA? Circle 113, inside back cover



400 TON, 2-POINT ECCENTRIC PRESS operates at 18 strokes per minute, has a bed area of 132 by 72 in. and a 20-in. stroke of slide with a 10-in. adjustment. Full eccentric drive employs no crankshaft, and delivers greater torque and maintains greater production accuracy due to its box type slide and barrel-type adjustment—*The Cleveland Punch & Shear Works Co, 3917 St Clair Ave, Cleveland 14, Ohio*

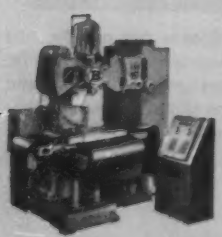
MORE DATA? Circle 114, inside back cover

PELTON DIVISION, BALDWIN-LIMA-HAMILTON CORPORATION USES Burgmaster

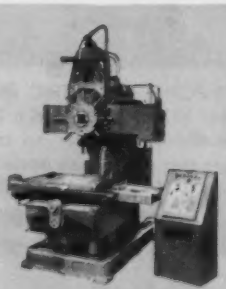
14 "in-a-line" Operations, C'Drill, Drill, Bore and Ream, at each of four 90° turns

Over 96 Different Parts Programmed In Tape

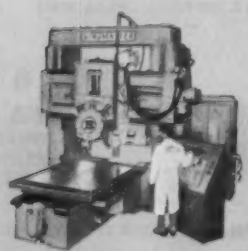
Model 25AHT 6 spindle, 1¼" capacity in steel. Table travel 15 x 26, 20 x 30, 30 x 45.



MODEL 2BHT 6-spindle, ¾" capacity in steel. Table travel 10 x 18, 15 x 26, 20 x 30.



MODEL 3BHT 8-spindle, 1½" capacity in steel. Table travel 20 x 30, 30 x 45.



MODEL 3BHT-B DOUBLE HOUSING, PLANER TYPE 8-spindle, 1½" capacity in steel. Table travel 48 x 60.

TAPE-CONTROLLED TURRET DRILLS

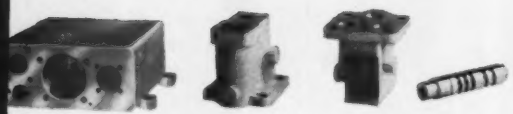
Triples Production... Eliminates Rejects...

Pelton Division, Baldwin-Lima-Hamilton Corporation, San Francisco, California has over 96 different parts programmed in tape for machining on their Burgmaster Tape-Controlled Model 25AHT Turret Drilling machine. One of these parts is a Gate Limit Valve Cage machined from Hard Naval Brass. In this operation, Pelton's tape-controlled Burgmaster automatically center drills, drills, bores and reams 56 different holes in only 23 minutes . . . to hole location of ±.001". Production in this single operation has been increased 3 to 4 times over former methods. Multiply this by 96 different parts and you understand why you should get the facts on Burgmaster Tape-Controlled 6- and 8-Spindle Turret Drilling Machines.

JOB FACTS

Company: Pelton Division, Baldwin-Lima-Hamilton Corp., San Francisco, California
Machine: Burgmaster Model 25AHT Tape-Controlled Turret Drill
Part: Gate Limit Valve Cage
Lot Size: 17
Holding: Manually rotated index fixture
Machine Operations:
20 holes — center drill
12 holes — drill through
8 holes — drill
8 holes — bore .183
8 holes — ream .188
Former Method: Drilling Machine with box jig
Present Method: Burgmaster Model 25AHT Tape-Controlled Turret Drilling Machine
Program Part: 15 min.
Savings: 45 min. each part
Other Advantages: Closer tolerances, fewer rejects, faster set-ups, less operator fatigue, increased production, lower inventory.

14 "in-a-line" operations center drilled, drilled, bored, and reamed at each of four 90° turns with Burgmaster Tape-Controlled Turret Drilling Machine



Four of over 96 parts machined with Burgmaster Tape-Controlled Turret Drill

"Tool Crib of the Sixties" — Over 96 different parts programmed in tape up to this time.

World's Largest Builder of Turret Drilling Machines

"0" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ¾" Capacity

2BR Ram Type Radial Drill ¾" Capacity

2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity

25AH T Automatic Tape Controlled 1¼" Capacity

2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

Send for Literature

Write for bulletin describing Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling, Tapping and Boring Machines. Forty minute 16 mm sound film showing all Burgmaster Turret Drills in operation is available without charge from any office.

Burgmaster CORPORATION

15001 S. Figueroa Street • Gardena, California • FAculty 1-3510 DAvis 9-4158

BURGMASTER DIRECT SALES OFFICES: Ridgewood, New Jersey, 86 North Maple Avenue., GIlbert 4-3002 • Chicago 5, Illinois, 4908 Lincoln Ave., LOng Beach 1-1178 • Cleveland 7, Ohio, 14706 Detroit Ave., ACademy 6-7030 • Detroit 37, Michigan, 13730 W. Eight Mile Road, Lincoln 8-4333 • Northern California, Castro Valley, JEfferson 7-1650 • Kearney & Trecker, C.V.A. Ltd., Sole Agents for Great Britain, British Commonwealth and Western Europe.

NEW!

Faspiral TAPS

Remarkable performance, sensational cutting action . . . resulting from 52° helix flutes. Available in

PLUG (3-4 thread) or BOTTOMING CHAMFER and standard in

Crōmclad®

Crōmclad surface treatment, less than .000050" and uniform in depth on the thread form, combines with this new design to promote improved lubricity and lower the torque requirement *thus greatly reducing breakage.*

Write for Catalog

NEW ENGLAND TAP COMPANY, INC.
5 Endicott St., Norwood, Mass.

Person_____

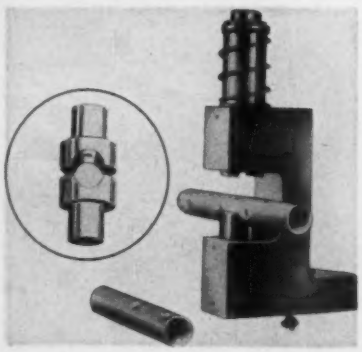
Company_____

Street_____

City & State_____

SPECIAL WELDER SPOT WELDS upper and lower hinge reinforcements and extension parts to inner door panels of automobile doors. The machine has 32 hydraulically operated spot welding guns powered by 9 50-kva packaged-type welding transformers. An operator loads three parts into the lower die then places the inner door panel in opposition. Push button switches start the machine and the lift table will raise the panel into position. The extension piece is welded and the guns then shift and the two hinge reinforcements are welded. After welding the lift table lowers for unloading—*The McKay Machine Co, Federal Warco Div, Warren, Ohio*

MORE DATA? Circle 115, inside back cover



Tube Piercer Allows Easy Change From One Diameter To The Next

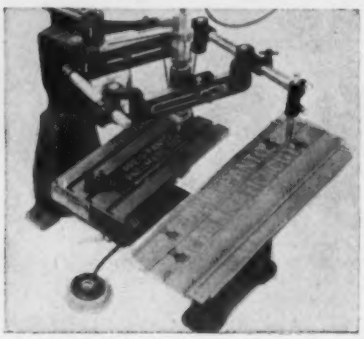
An improved tube piercing unit incorporates easily removable, interchangeable tube retainers that permit quick change-over from one tube diameter to the next without disturbing the set-up in the press or on the template.

The piercer, which will make one hole only or two opposite holes, with one stroke of the press can also make holes of different diameter and configuration without mandrels.

Distortion is said to be held to a minimum by the complete enclosure of the tubing during perforation and multiple punching can be done by arranging several units in a press or press brake.

Tool Products Corp, North Tonawanda, NY

MORE DATA? Circle 116, inside back cover



PANTO-ENGRAVER MODEL UE3-PC is similar to the model UE-3 but has a pneumatic attachment for raising and lowering the cutter spindle. Standard hand actuated cam lever depth mechanism unit is eliminated so that the operator is not required to reach across the pantograph to raise or lower cutter from letter to letter.—*H P Preis Engraving Machine Co, Hillside, NJ*

MORE DATA? Circle 117, inside back cover

possibilities unlimited

for lowest cost per drilled hole!

Take a U.S. Universal Adjustable Drill Head

. . . equip it with slip spindles, and a jig-bored slip spindle plate for every production hole-pattern job you have (or want) within the capacity of the head;

. . . for each long-run, complicated or multi-piece setup, use a plain or indexing holding fixture and guide bushing plate;

. . . for short runs, merely locate the standard adjustable arm brackets quickly and accurately with a bushing plate.

Do this with as many different size U.S. Drill Heads as you need to cover the entire range of multiple hole work in your shop.

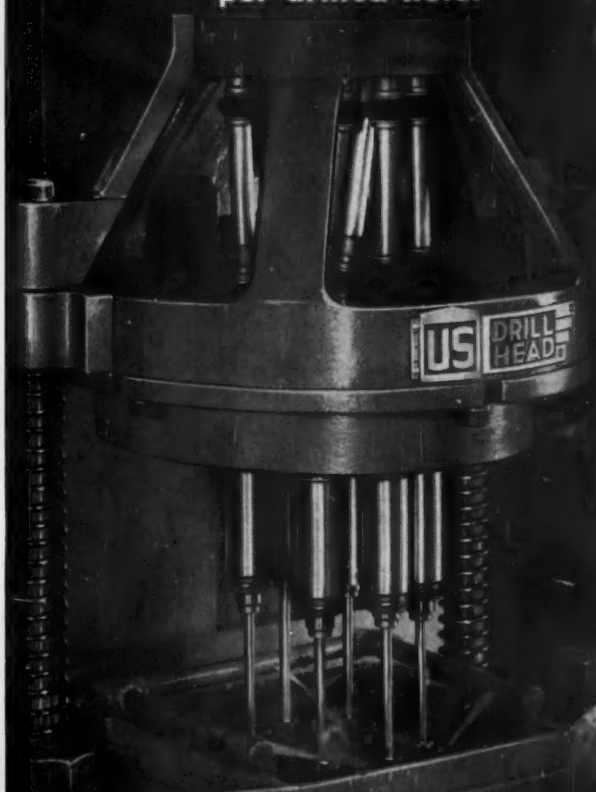
You now have possibilities unlimited for lowest cost per drilled hole! And, if your machines have a reversing spindle, you can *drill and tap with the same head!*

Check these possibilities on your jobs . . . call your U.S. Drill Head Representative, or contact us direct.

For descriptive data, ask for Catalog AD-57.

Style U-2 Head drilling housing flange. Inset shows "tool crib" of drills and slip spindle plates used with this head on 17 other setups.

U.S. Universal Heads are built in 8 models, 6 to 12 spindles, 6" to 15" drilling areas, ¼" to 1 1/16" capacities. Positive drive, hardened shaved gears, super finish spindles, heavy-duty lifetime-lubricated joints.



UNITED STATES DRILL HEAD CO.

5298 River Road · Cincinnati 33, Ohio

US DRILL HEAD

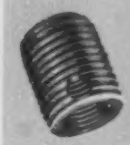
Adjustable and Fixed Center Multiple Drilling Heads—
Individual Lead Screw Multiple Tapping Heads — and Fixtures.

The quickest most practical way to put strong threads in soft materials

the TAP-LOK® INSERT

SLOTTED

IN SOFTER METALS AND PLASTICS... Has full V-form external threads to provide maximum locking torque and permit wide choice of mating hole sizes. Recommended for soft aluminum, zinc die castings, sand castings and plastics. Meets requirements of MIL-MS-35914.



H-SERIES

FOR HIGHER STRENGTH MATERIALS... Has heavy wall and truncated root external thread and three-hole cutting edges for hard-to-tap higher-strength materials and to meet MIL and other specs calling for Class 3B thread fit for gaging after installation.

F-SERIES

ELIMINATES CHIPS... The F-Series Form-Lok self-tapping insert is thread forming and firmly locks itself in the base material. Available from stock in sizes #4 through ⅜".

W-SERIES

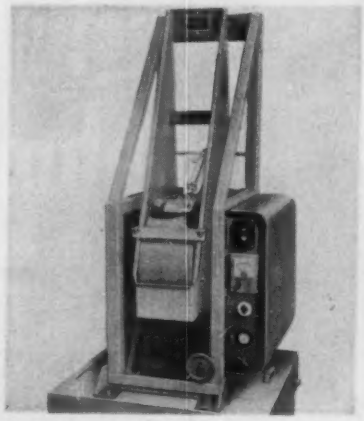
FOR WOOD... Has coarse pitch external threads offering maximum strength in combination with ability to be driven into thin sections without splitting them. For furniture, cabinets and other wooden parts where strong, permanent threads are needed, or that are frequently assembled and disassembled.

SEE OUR CATALOG IN SWEET'S

Another fastener development from—

TAP-LOK / GROOV-PIN CORPORATION

1145 Hendricks Causeway, Ridgefield, N. J.



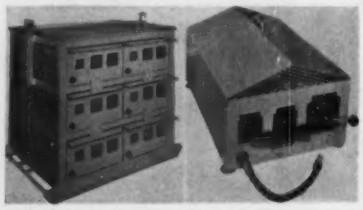
Orbital Finishing Machine Has Re-Circulating Wash System

The Vi-Brader, designed with a re-circulating wash system, provides continuous washing action on both media and parts during deburring, radius forming, or polishing operations. Wastes are removed, compounds remain uncontaminated, and the processed parts do not require a separate cleaning cycle. The system maintains a regulated flow of water into the processing tub, removing waste water through a screened drain opening at bottom.

Unit, which rotates the load in a circular controlled orbit, has adjustable speed control, choice of conventional tumbling barrels or tubs, and full 1-¼ cu-ft capacity.

Rampe Mfg Co, 14915 Woodworth Ave, Cleveland 10, Ohio

MORE DATA? Circle 118, inside back cover



Weld Control Resistor Units Simplify Arc Welding

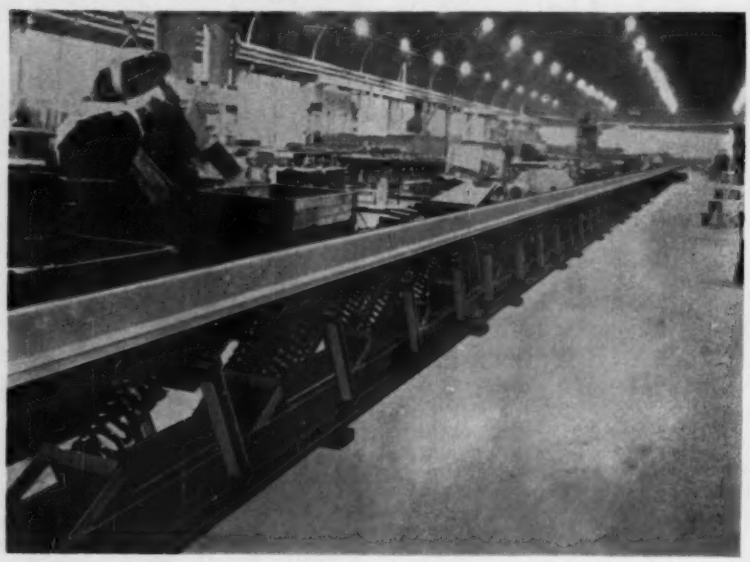
The Weld Grid Control Resistor provides a simplified method for the accurate control of weld current in arc welding processes. It is currently available in three-man and six-man station models, as well as in a single station unit.

Features include the use of high-temperature wire for long-lasting service and waterproof input and output connectors.

Smith-Dolan induction heaters (also made by the company) need only the grids to convert into a complete ac welding machine.

Electric Arc Inc, 152-1 Jelliff Ave, Newark 8, NJ

MORE DATA? Circle 119, inside back cover



VIBRATING CONVEYORS are operated by reclaiming energy created by natural frequency vibration of coil springs so that conveying capacity can be varied infinitely from zero to maximum while the conveyor is in operation. Material is moved along with a tossing and catching motion rather than a sliding or batting action. Because of the springs, power requirements are low and there are no dead spaces and the trough or pan is self cleaning. Capacity of the 300-ft-long conveyor is 6 tons per hour—*Stephens Adamson Mfg Co, Aurora, Ill*

MORE DATA? Circle 120, inside back cover

ONLY SQUARE D STARTERS WITH 1-PIECE OVERLOAD RELAYS GIVE *Absolute* PROTECTION!

• Only Square D makes thermal overload relays with 1-piece construction—and only with 1-piece construction can you *know* you've installed the heater correctly. Square D 1-piece overload relays can be installed only one way. They are factory-assembled, individually tested and calibrated, completely tamper-proof. Repeated tripping will not affect accuracy.

You *pay* for overload protection—be sure you *get* it. Insist on Square D 1-piece overload relays for *absolute* protection.

Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.

D EXCLUSIVE— 1-piece Overload Relay for *ABSOLUTE* Protection!

Mail coupon today for simple "jig-saw" demonstrator —see why only Square D gives absolute protection

Square D Company
Department SA-238
4041 North Richards Street
Milwaukee 12, Wisconsin

Please send me information on Square D magnetic starters, along with your simple 3-minute "jig-saw" demonstrator

NAME_____

COMPANY_____

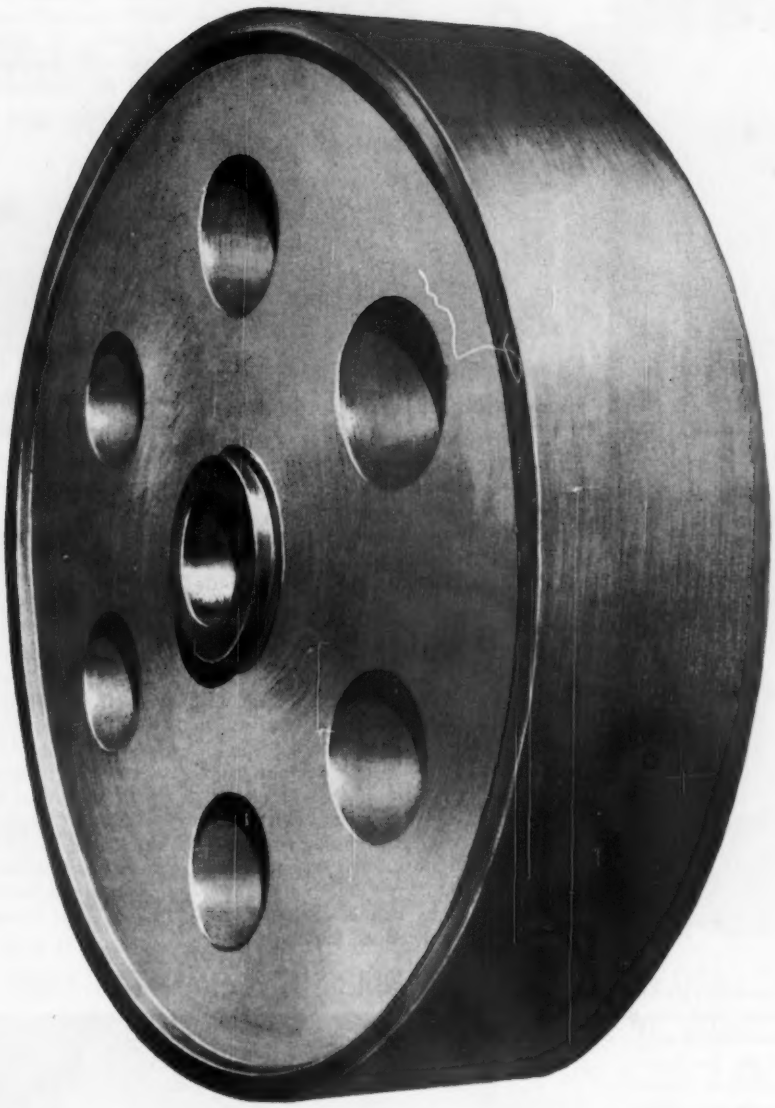
ADDRESS_____

CITY_____ ZONE____ STATE_____

SQUARE D COMPANY

wherever electricity is distributed and controlled

THE BEST WAY TO CUT THE COST OF A CAST GEAR LIKE THIS...



IS TO START WITH AN ALCO FABRICATED GEAR-BLANK LIKE THIS

ALCO's Hi-Qua-Led Steel® forged and rolled rims now make fabricated gears less expensive than cast gears. Hi-Qua-Led, with lead added by a special process, lowers machining time as much as 50%, extends tool life many times. Costly repairs of casting defects are eliminated. Besides lower cost, you end up with all the advantages of a forged gear—maximum strength, toughness and fatigue resistance. Hi-Qua-Led forged and rolled gear blanks are available in any steel analysis, from 18 to 160 in. OD and to 24 in. wide. For more information write to ALCO Products, Inc., Dept. 1502, Schenectady 1, N.Y.

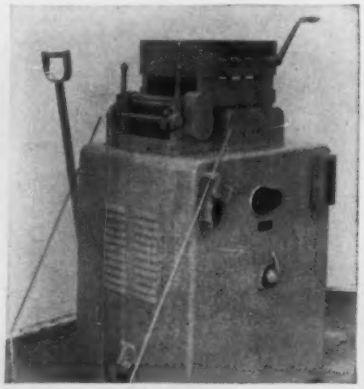
ALCO **ALCO PRODUCTS, INC.** *Product quality comes first*

Don't overlook

DeVilbiss power spray washers

DeVilbiss automatic parts washers clean faster and more thoroughly because they're engineered specifically for the job—for continuous conveyor operation or batch-type work. Units available in both standardized and custom designs to meet your exact operating problems. Send for Catalog 1101, or contact your local DeVilbiss representative for a specific recommendation and prompt quotation. The DeVilbiss Company, Toledo 1, Ohio. Offices in principal cities.

FOR TOTAL SERVICE, CALL
DEVILBISS



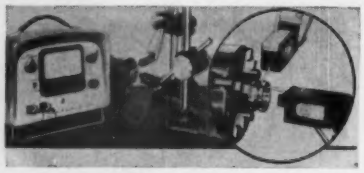
Power-Driven Straightener Takes Materials Up to 90 in. Wide

Units, specifically designed for removal of coil set prior to feeding into a punchpress, shear, or other fabricating machine, feature straightening rolls which can be collectively or individually adjusted to provide quicker setup and to better handle varying stock conditions. They can be used in conjunction with all types of automatic feeds or in hand feeding operations. Available in a wide range of sizes and types, they will process materials in widths up to 90 in. and thicknesses to 0.210 in.

Additional features include completely enclosed, heavy-duty, variable-speed drive system with gears running in oil; automatic control by a dancer roll through use of an adjustable cam time delay; straightening rolls are connected through a gear train to reduce backlash; overshot roll in upper bank provides better straightening for materials with unusual characteristics.

Frank W Egan & Co, Metal Processing Equipment Div, S Adamsville Rd, Somerville, NJ

MORE DATA? Circle 121, inside back cover



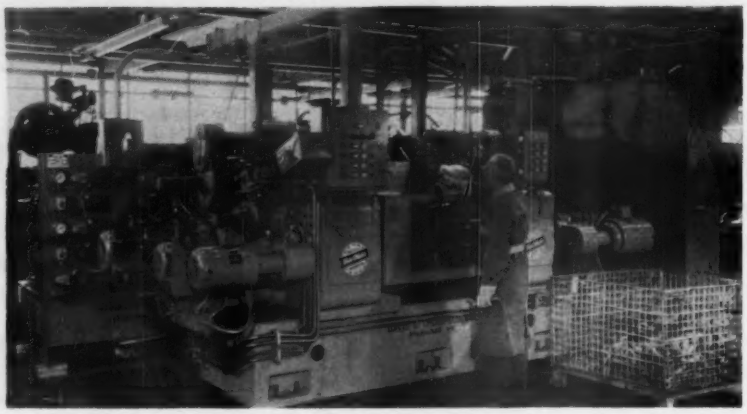
Differential Gaging Equipment Eliminates Need for Fixturing

Use of simple electronic-type gaging equipment, reported to give millionths accuracy, eliminates need for expensive mechanical fixturing. Basic equipment required consists of two identical gage heads and a differential input amplifier. Principle of operation is that of cancellation of the fixturing or environmental errors affecting the measurement so that only the desired dimension is indicated on the meter.

Applications include measurement of the true roundness of journals on parts weighing up to four tons in production and concentricity of ID and OD of small bearings using nonprecision spindles.

Cleveland Instrument Co, 737 Carnegie Ave, Cleveland, Ohio

MORE DATA? Circle 122, inside back cover

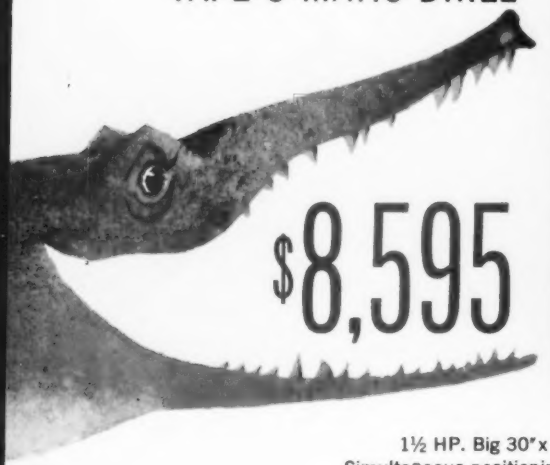


ROTA-MATIC HORIZONTAL TRUNNION MACHINE is designed so that each station performs its own set of functions and has individual control of feeds and speeds. With provision for addition of milling heads, practically any combination of machining operations can be done. Machine illustrated has three station index arranged to produce two workpieces per index. Production is 240 universal joint yokes per hr—*Davis & Thompson Co, Milwaukee 18, Wisc*

MORE DATA? Circle 123, inside back cover

WE'RE PUTTING OUR MONEY WHERE OUR MOUTH IS!

WITH A 90-DAY MONEY-BACK GUARANTEE ON THE NEW PRATT & WHITNEY TAPE-O-MATIC DRILL



$8,595

1½ HP. Big 30" x 20" table.
Simultaneous positioning of both axes.
(3 HP. optional at extra cost.)

NOW! FOR THE FIRST TIME A NUMERICALLY CONTROLLED DRILL FOR ONLY $8,595 GUARANTEED TO REDUCE YOUR DRILLING COSTS

At last . . . a drill with the finest, transistorized, numerical-control system available for only $8,595 . . . because P&W brings mass production to the machine tool industry for the first time . . . yet maintains the 100-year tradition of P&W quality.

The TAPE-O-MATIC enables **you** to benefit from numerical control . . . to gain a vitally-needed, important competitive edge.

WE BELIEVE IN THIS NEW DRILL SO STRONGLY THAT WE OFFER:

1 90-DAY, MONEY-BACK GUARANTEE. If by 90 days after purchase, this drill has not reduced your drilling costs, return it for refund, less transportation costs.

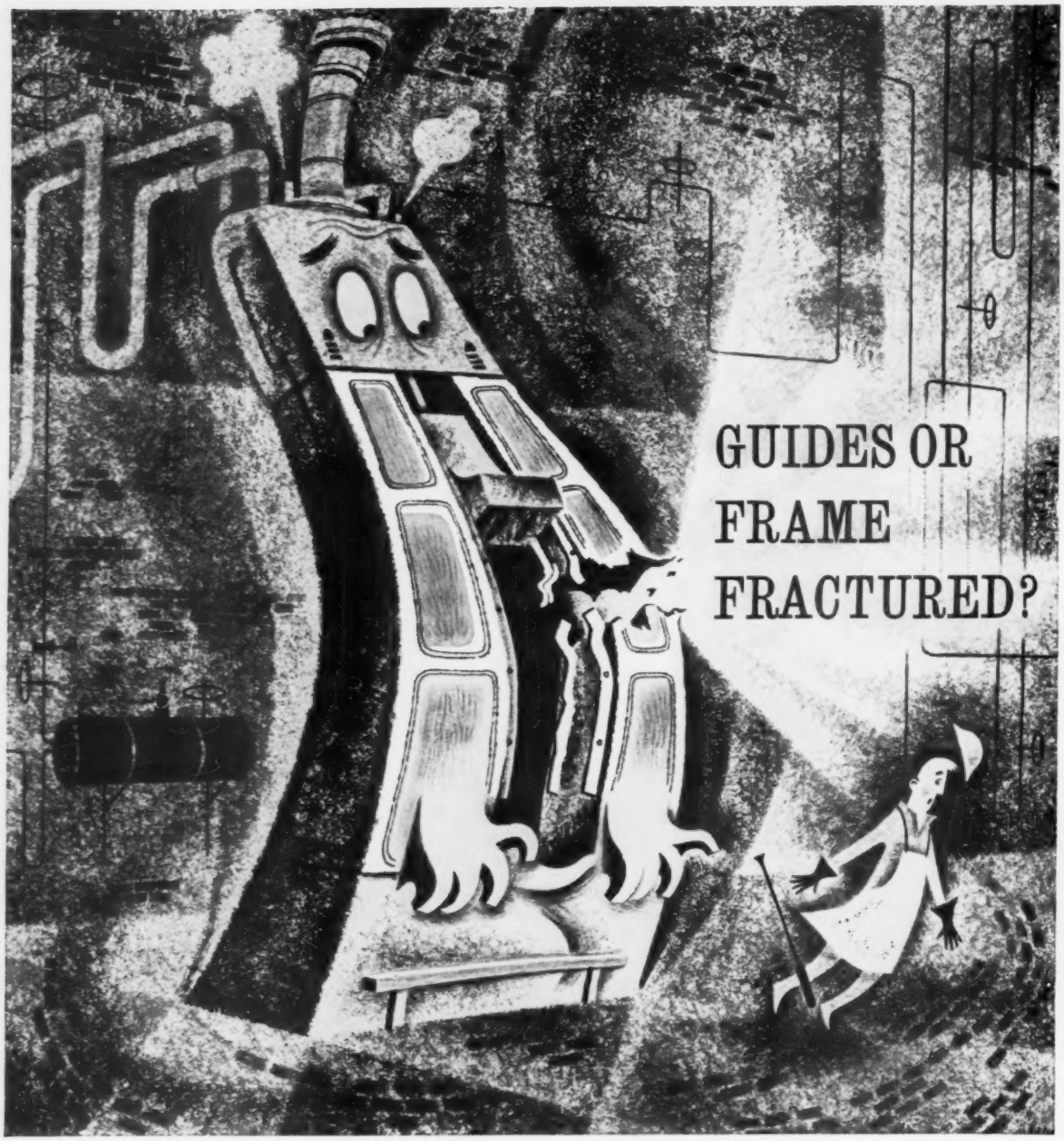
2 5-YEAR WARRANTY. We fully warrant the TAPE-O-MATIC drill against defective parts and workmanship for 5 years from date of purchase.

3 UNIQUE TERMS. You can buy TAPE-O-MATIC using our exclusive Trade-in Plan. You can purchase the drill outright, lease it, or lease it with option to buy. ONE PER CENT CASH DISCOUNT FOR PAYMENT IN 10 DAYS.

Call collect . . . your local Pratt & Whitney representative, now! Or write to: Paul N. Stanton, Vice President Marketing; Pratt & Whitney Co., Inc.; Charter Oak Blvd.; West Hartford, Conn.

PRATT & WHITNEY
A MAJOR INDUSTRIAL COMPONENT OF
FAIRBANKS WHITNEY
Machine Tools / Cutting Tools / Gages

HEADQUARTERS FOR AMERICA'S WAR AGAINST OBSOLESCENCE



Call ERIE FOUNDRY
for forging hammer replacement parts

Replacement guides, frames, and other parts for a wide variety of forging hammers of most any make are available from ERIE. They are high in quality, competitive in price.

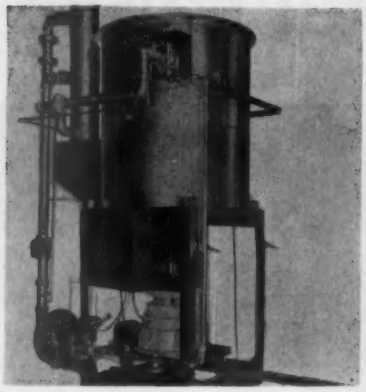
For over 65 years we have specialized in the design, development and manufacture of forging hammers of all types. Logically, then, Erie Foundry is a natural source for repair parts equal in quality and performance to the original equipment. Substantial inventories assure you of prompt service. For more information on repair parts or our complete Hammer Rebuilding Service, write Mr. James Walker.

ERIE

ONE OF THE GREAT NAMES IN FORGING SINCE 1895

Manufacturers of Forging Hammers • Forging Presses • Hydraulic Presses • Trimming Presses

ERIE FOUNDRY CO., Erie, Pa.



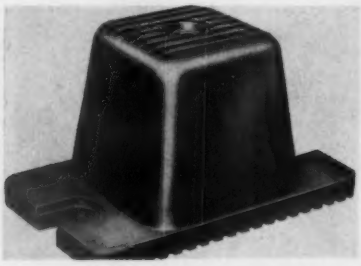
Gas-Fired Furnace Operates to 3300 F

Complete heating and cooling program control system governs operation of this elevator Model GFHT-24 high-temperature unit. Design utilizes a full FIA gas safety system and meets JIC electrical standards. Rapid attainment of the 3300 F max operating temperature is accomplished by use of preheated air.

Refractory shapes comprising the furnace arch are cast and prefired and can be replaced from the top. Units are available with setting spaces ranging from 12 in. in dia and 18 in. high to 48 x 72 in.

Harrop Precision Furnace Co, 3470 E Fifth Ave, Columbus 19, Ohio

MORE DATA? Circle 124, inside back cover



Elastomer Mounts for Machinery Provide High Deflection

Series F mounts provide up to ½-in. static cushion (deflection) for improved isolation efficiency as compared with the ¼-in. deflection commonly provided by existing rubber-in-shear units. Design incorporates the isolation characteristics of compression and buckling, as well as of shear loading. Wide range of load carrying capacities from 10 to 5000 lb is provided by a selection of 12 sizes and durometers. Dimensions range from ⅞ in. in height to 2¾-in. for the largest unit.

Korfund Co, Shock & Vibration Div, 39B Cantiague Rd, Westbury, NY

MORE DATA? Circle 125, inside back cover

These are probably the most efficiently engineered twist drills available to industry today. That's why we say . . .
Don't buy Drills
Buy Holes !
Write for Catalog 98 pages
Buy
AMERICAN
AMERICAN TWIST DRILLS
A Subsidiary of: Cutting Tool Division
Brown & Sharpe Mfg. Co.
14301 West Chicago Blvd.
Detroit 28, Michigan

Rockwell Metal Lathes

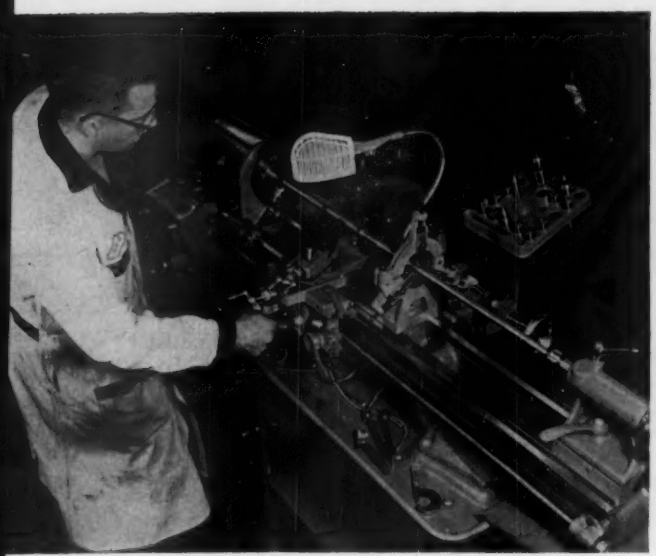
give you better performance on your job

Match the performance you get from Rockwell's Delta Metal Lathes—model for model—against any in the field. Make your own tests for close tolerance, precision work—then compare these with the printed profile of final quality control test results made on each machine at the factory. You'll judge the price in terms of value on the job—now and years from now.

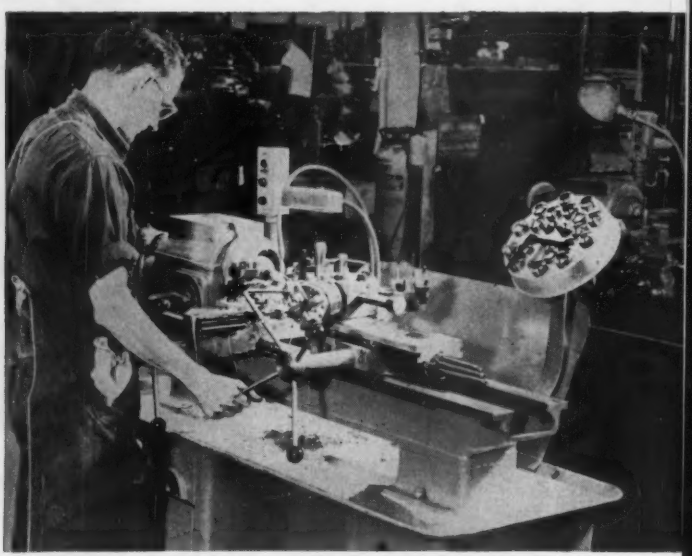
Write for FREE Catalog and the name of the distributor nearest you. He's a Lathe Specialist—the man with big news on new lathe developments from Rockwell.

Rockwell Manufacturing Company, Delta Power Tool Division, 618M N. Lexington Ave., Pittsburgh 8, Pa.

DELTA INDUSTRIAL TOOLS
another fine product by
ROCKWELL



10" "Long Bed" Lathe in the tool room gives you 36" capacity between centers with big machine features at surprisingly low cost.



Hand Screw Machine for short run, multiple operation work fills the gap between standard engine lathes and expensive automatic screw machines.

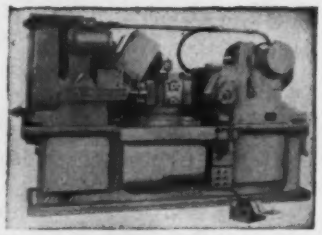
● **11" Lathe on the production line has the "beef" you need to make heavy cuts in anything from brass to titanium.**

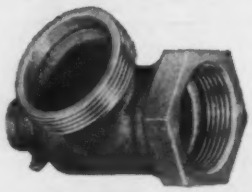
...and parts are finished without rehandling on

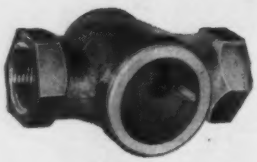
GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

The Goss & DeLeeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & DeLeeuw and only Goss & DeLeeuw offers this feature in a standard chucking machine.



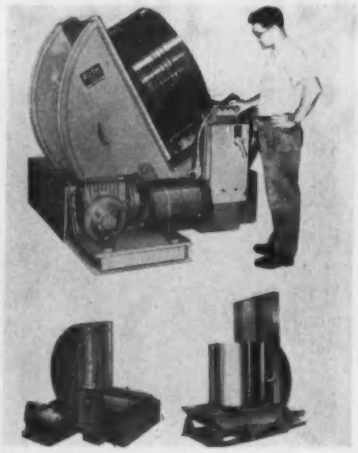




A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

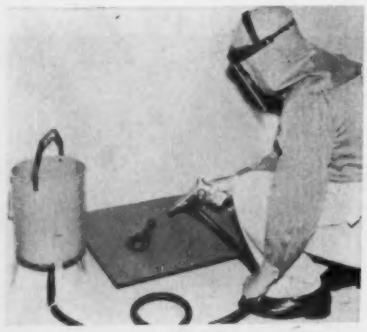


Device Simplifies Handling Of Coiled Strip Metal Stock

The Upender is designed for handling metal coils delivered flat to fabricating plants without hoists, slings, or cradles. Coil is conveyed or placed on the Upender which turns the axis through 90° to place it in a vertical position. Minimum drive motor power is required because the design of the device permits rotation of the coil about its center of gravity.

Roth Corp, Lorain, Ohio

MORE DATA? Circle 126, inside back cover



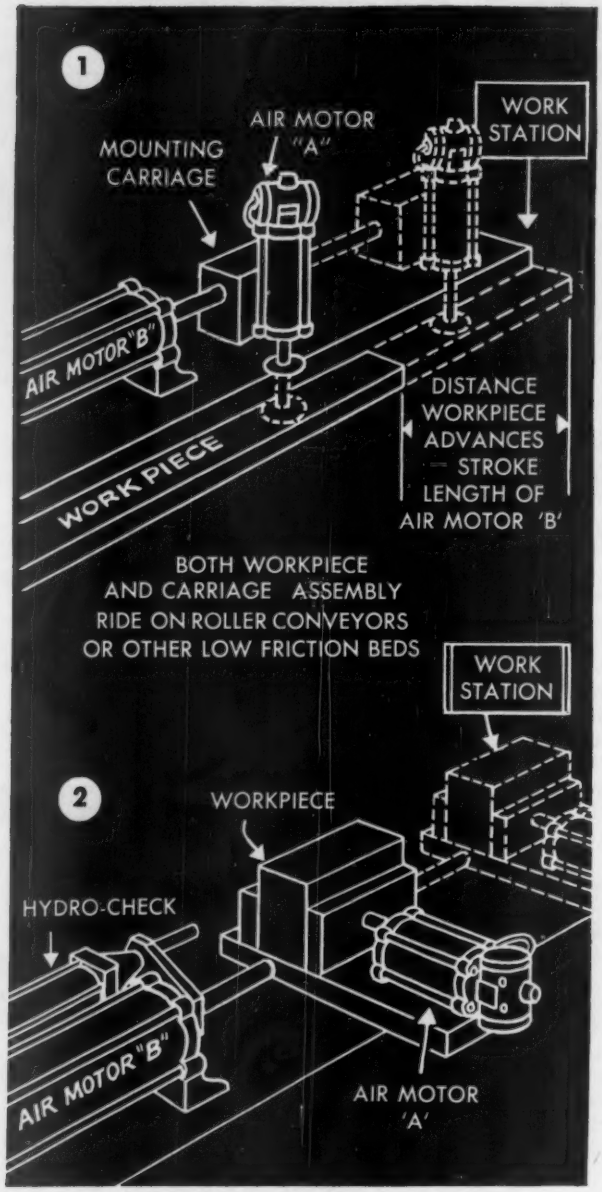
Compact, Lowcost Sand Blaster Furnished in Portable Model

Unit removes rust, paint, and chemicals, cleans core boxes and patterns, and accomplishes blasting jobs that formerly required larger and more complex equipment. It will operate with any hard, dry, abrasive material and can be attached to existing air sources. The model comes complete with pistol-grip blast gun, extra air jets and nozzles, six feet of hose, and a 12-qt-capacity abrasive container. A hood and face shield are also included. Total cost is $39.95.

Frederic B Stevens Inc, 1800-18th St, Detroit 16, Mich

MORE DATA? Circle 127, inside back cover

TWO IDEAS YOU CAN USE TO FEED AND POSITION WORK AUTOMATICALLY



In most plants today, there are few operations which present greater cost-cutting opportunities than the feeding and positioning of workpieces. Yet often this potential saving remains untapped because the high cost of special workfeeding and positioning equipment may not appear justified.

However, using Bellows Air Motors®, fast, accurate, trouble-free devices to "spot-automate" such operations can be built in your own plant—by your own men—for a fraction of the cost normally involved in such equipment. These two devices are typical:

Fig. 1, at left, shows a set-up used frequently to feed steel bar stock to a cut-off saw, to feed strip metal to a punch press, to position a strip of wood for drilling holes at regular intervals along its length, and in other applications where it is desired to alternately advance a workpiece and pause while an operation is performed. By proper positioning of work stations, it is possible to perform a sequence of operations, such as drill-and-tap, or punch , form-and-stencil.

After the piston rod of Air Motor "A" has advanced to hold the workpiece, the piston rod of Air Motor "B" advances, moving carriage, Air Motor "A" and workpiece a predetermined distance forward. Workfeeder pauses while the operation is performed. Then, Air Motors retract —and the sequence is repeated.

Variations of the extremely simple set-up shown in Fig. 2 are used in virtually every industry. With the piston rod of Bellows Air Motor "A" advanced to clamp the work, Air Motor "B" advances the workpiece to the work station, pauses during the operation, then retracts. Operator unloads, reloads, and the sequence repeats. Incorporation of a Bellows Hydro-Check® provides a perfectly controlled, highly accurate feed rate, permitting this set-up's use with routers, drills, milling machines and similar equipment.

* * * *

In addition to The Bellows Air Motor, used as the "heart" of work feeding and positioning devices designed and built by creative production management everywhere, Bellows-Valvair also produces a line of Rotary and Linear Feed Tables, as well as a series of Rotary Index Tables—all completely integrated pneumatic "packaged" units including all controls and built-in wiring.

851-C

INTERESTED IN CUTTING WORKFEEDING COSTS?

If so, you'll want the special "package" we've made up. It includes a "Spot-A-Mation Idea" File, containing information on a number of different workfeeders, as well as complete information enabling you to "spot-automate" scores of other operations. In addition, we've included specs on our Rotary Feed and Index Tables and Shuttle Work Feeders. For yours—without cost or obligation—address: Dept. AM-1261, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair
Division of IBEC AKRON 9, OHIO

These names assure you the best in pneumatic, hydraulic and electronic components
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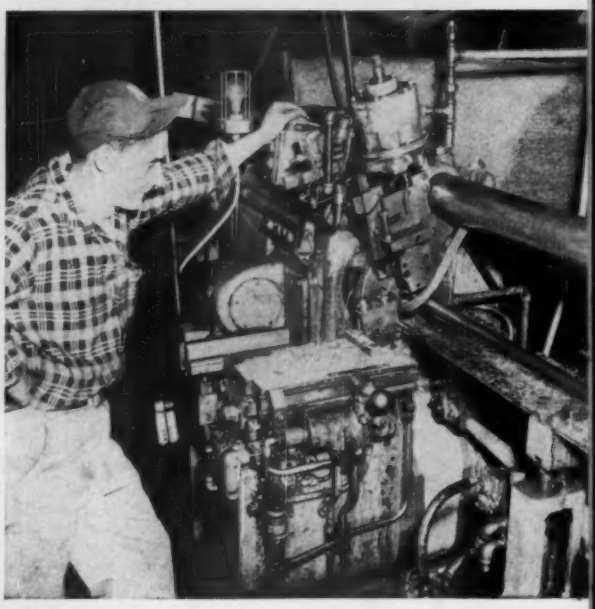
"Flexible Automation"

WITH BARDONS & OLIVER CUTTING-OFF LATHES

at Falls Steel Tube & Manufacturing Co., Newton Falls, Ohio

At Falls Steel Tube & Mfg. Co., manufacturers of exhaust pipes, tail pipes, and similar automotive tubular parts, the output of two electric weld tube mills is automatically transferred to three Bardons & Oliver loading tables. The tubing is then fed into three Bardons & Oliver Cutting-Off Lathes and automatically cut off in any required length from 6 inches to 10 feet. The cutoff lengths are automatically unloaded into tote trucks. Besides wide variance in length, tubing diameters vary from ½ to 3 inches and wall thickness from 14 to 20 gauge.



Victor Beltram, Chief Engineer, reports labor reduced by 75% and cutoff capacity increased by 50% with the Bardons & Oliver installation. Previously, cutoff operations were performed on circular sawing machines. The cutting-off lathes produce square ends and smooth finishes which have greatly facilitated secondary operations. The increased cutoff capacity has allowed greater utilization of all plant facilities. The complete Bardons & Oliver installation has paid for itself in less than three years.

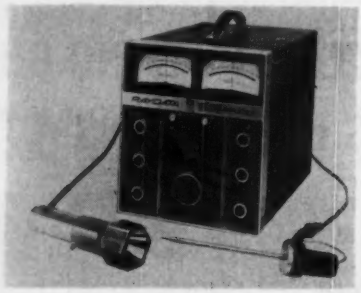
If you cut off spacers, bushings, nipples, couplings, rollers, similar tubular products, or solid bar stock, we suggest you explore the profit possibility offered by these versatile machines. Bardons & Oliver manufactures a complete line of Cutting-Off Lathes ranging in collet capacity from 2 to 16 inches.

BARDONS & OLIVER

BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes

CIRCLE 384 READER SERVICE CARD



Vibration Analyser Compares Signals From Two Separate Pickups

The Model 40 vibration analysis has calibrated panel meters to indicate the frequency and amp'itude in the microinch range from pickups applied to machinery. Unbalance phase data is provided by a high intensity stroboscope flashed in syncronism with the resulting frequency of vibration.

Two separate panel-selected inputs provide immediate comparison of vibration signals from two separate pickup points. The pickups may be of different types such as, crystal accelerometers, strain gauges, or LVDT's in addition to the magnetic velocity pickups normally used.

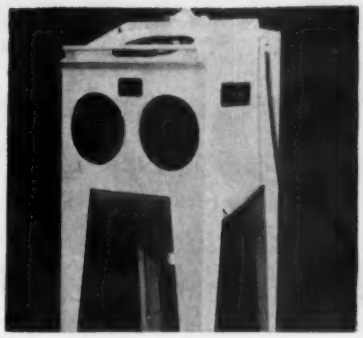
A selective filter separates the vibration frequency components over a range from 170 cycles per minute to 300,000 cycles per minute.

The unit, which has an exclusive peak hold feature for showing the peak value of transient signals on the meter, is fully transistorized and can be battery operated if desired.

Price of the analyser is $1890 less pickup.

Raydata Corp, 1078 E Granville Rd, Columbus 24, Ohio

MORE DATA? Circle 128, inside back cover



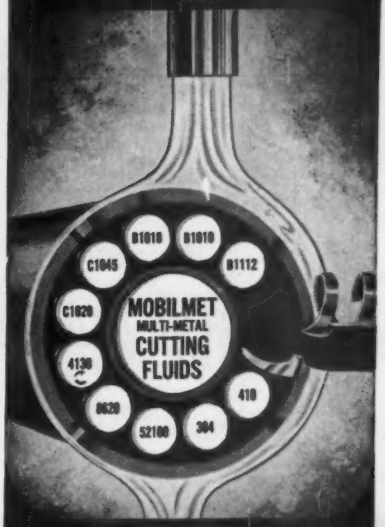
PEENAMATIC MODEL 953 wet or dry bast machine constructed of 3/16-in. steel plate features a packless slurry pump with a special wear plate. Cabinet working space is 24 by 24 by 20 in. and the machine will operate on air pressure as low as 25 cfm. Optional equipment includes window washers and removable hatches for long parts —*Metal Improvement Co, 1721 E 47 St, Los Angeles, Calif*

MORE DATA? Circle 129, inside back cover

AUTOMATIC DRILLING MACHINE drills, reams, and counter bores holes in various diameter rings used in rockets and missiles. Machine has a variable torque electronic feed and is mounted on an Excello boring head. It indexes and repeats to the next station either automatically or manually—*BMW Manufacturing Co, Inc, 1740 Abalon, Torrance, Los Angeles, Calif*

MORE DATA, Circle 130, inside back cover

SEE AD ON FOLLOWING PAGES...



For more information on Mobilmet cutting oils use this coupon

Mobil

Mobil Oil Company, Room 2058J
A Division of Socony Mobil Oil Co., Inc.
150 East 42nd Street, New York 17, N. Y.

Gentlemen: I am interested in learning how Mobilmet cutting oils can aid my operation.

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POSITION

COMPANY

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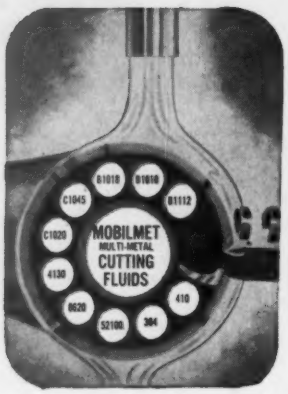
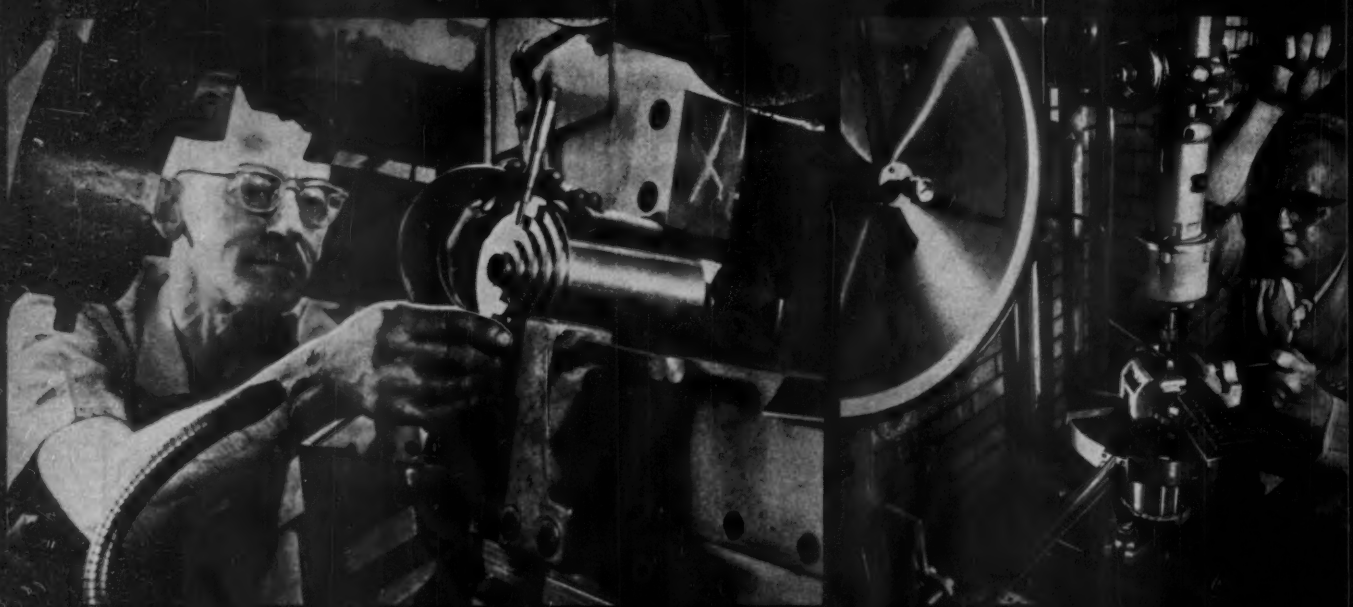
NOW, PRESSURE-TEMPERATURE SELECTIVE CUTTING OILS THAT ADAPT TO YOUR MACHINING OPERATIONS

Mobilmet Oils

the first multi-metal cutting fluids





Due to a unique additive combination, a single Mobilmet oil can be used on both soft, draggy metals and hard, brittle workpieces. As a result, there's less downtime for tool and cutting-oil changes. You get more production from each machine. And you save on handling costs, since you stock fewer oils. The wide range of Mobilmet applications includes: turning, drilling, boring, milling, gear hobbing, shaping and shaving, threading, tapping, pipe threading, surface and internal broaching, thread and form grinding, thread rolling, forming and special automatic screw machine operations.

In developing Mobilmet cutting fluids, Mobil research engineers made use of this Tapping Efficiency Tester to evaluate Mobilmet machining efficiency. In these tests and in field service on soft, draggy SAE1020 steel, new Mobilmet fluids out-performed cutting fluids designed specifically for this service.

Versatile new cutting oils offer you greater machine output, longer tool life, reduced loss from rejects, exceptionally wide range of applications! Now, after two years of exhaustive research and field testing . . . new Mobilmet* oils—the first multi-metal cutting fluids ever offered to the metalworking industry.

Mobilmet oils are uniquely versatile . . . help simplify your cutting oil requirements because each grade is effective over ranges of metals and operations beyond the capacity of any conventional product. And Mobilmet oils offer you superior machining results as well—in terms of improved finishes, longer tool life, and reduced staining.

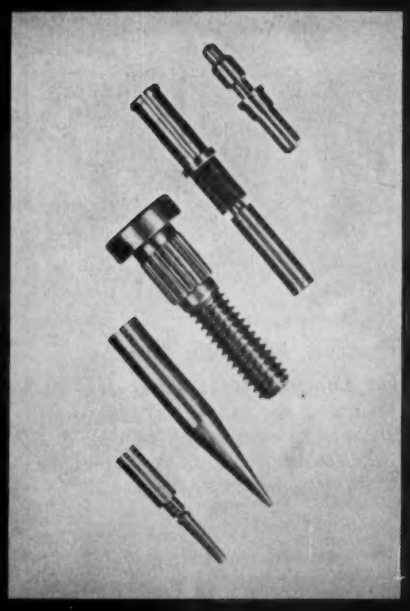
Behind this versatility and effectiveness: a new additive combination, developed and patented by Mobil, which is pressure-temperature selective in its activity and—highly effective over wide ranges of cutting pressures and temperatures. For complete information, call your Mobil Representative or use coupon on preceding page.

Mobil

*Mobilmet is a trademark of Socony Mobil Oil Company, Inc.

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N.Y.

Protected by heavy-duty Mobilmet, these pipe threading chasers, used for six weeks in moderately severe job-shop service, show little wear on either tool faces or thread crests. Mobilmet oils can mean longer tool life on soft or hard metals.



Because Mobilmet oils effectively control built-up edge and tool wear, you get superior finishes—fewer rejects. In some cases, Mobilmet oils reduce the need for additional finishing operations.

New additive combination in Mobilmet oils inhibits staining effect. Plate on left was immersed in conventional corrosive cutting oil; plate on right was immersed in heavy-duty Mobilmet suitable for same application. Repolished tops of plates show original condition.

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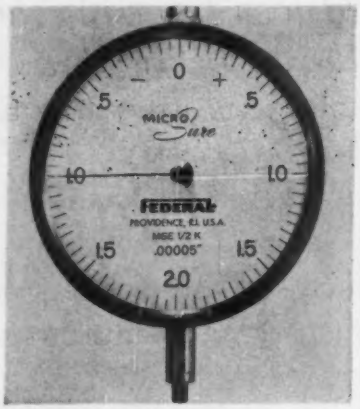
NEW SHOP EQUIPMENT



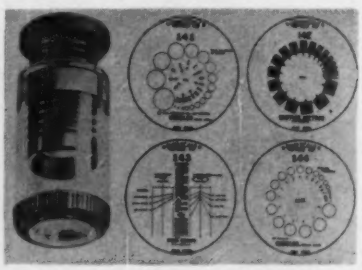
Dial Indicator Provides 2500:1 Magnification

Micro-Sure MSE ½ K, with 0.000050-in. graduations and a 3¼-in. diameter dial, provides exceptional accuracy over the full AGD range of 0.010 in. Calibration accuracy is within 0.000050 in. (total allowable error); repetitive accuracy is within 0.000005 in.

Design enables the indicator movement to follow plunger motion instead of being driven by it, providing positive protection against shock in either direction.

Federal Products Corp, Providence, RI

MORE DATA? Circle 131, inside back cover



Finescale Adds Four Reticles For Comparator to Line

Four new reticles for the company's magnifying comparator include; No. 141, circles, inch sizes, seventeen open circles from 0.005 to 0.125 in. diameter; No. 142, widths, metric sizes, bars varying from 0.1 to 2.0 mm in width in increments of 0.1 mm; No. 143, drill points, shows correct point angle and lip clearance for drilling various materials; No. 144 circles, metric sizes, open circles from 1.0 to 20 mm dia in increments of 0.1 mm. Prices for the reticles are $1 a pair with one having black lines and the other, white.

Finescale Co, 218 Southwestern Ave, Los Angeles 4, Calif •

MORE DATA? Circle 132, inside back cover

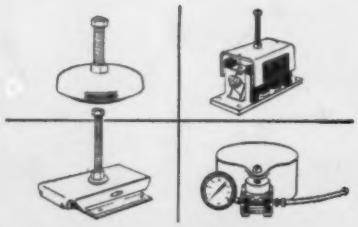
ARE YOU *JUST 4 FEET* FROM EFFICIENCY?

If you have bolted the 4 (or more) feet of your machinery to the floor, you're missing the production efficiency that results from layout flexibility!

With your machinery feet on BARRYMOUNTS®, your own maintenance people can rearrange production lines *quickly*, and without worrying about shock, vibration or noise problems.

Only Barry can offer you *quality-engineered* machinery mounts to answer your particular needs. Three different resilient elements: neoprene, helical springs or air provide the versatility required for every mounting requirement. In addition, you get built-in leveling . . . machine mobility . . . and freedom from shock and vibration effects.

Barry's experience can help you gain higher production efficiency. Why not request a copy of Bulletin 60-04A, "Practical Considerations When Installing Machinery"?



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SHOCK • VIBRATION • MACHINE EFFICIENCY
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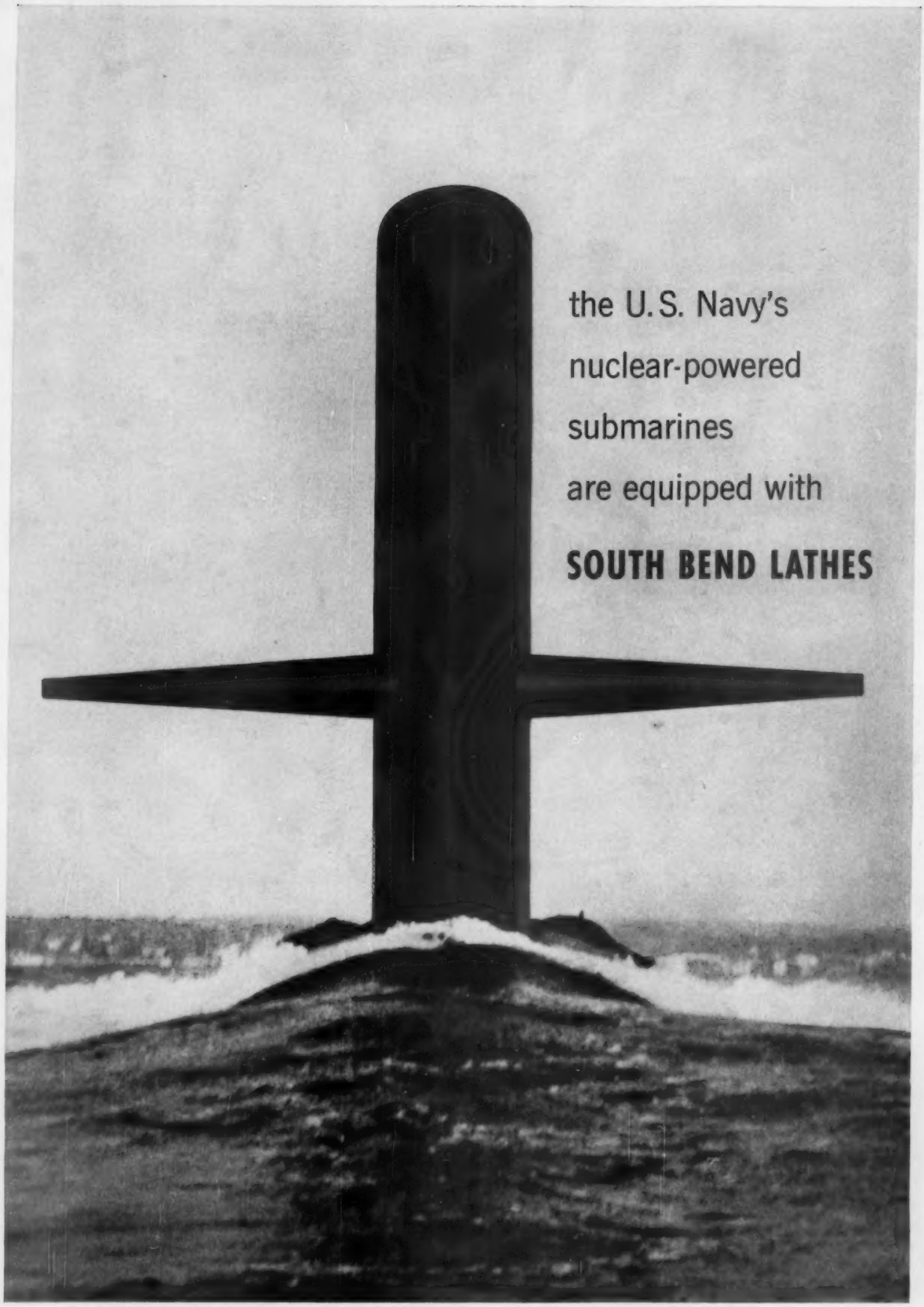


Official U.S. Navy Photograph

ARMOUR coated abrasives work for Foxboro

...exceed performance standards by 25%

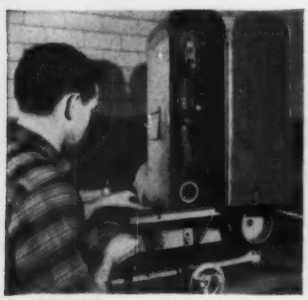
"We have used Armour coated abrasive belts exclusively for seven years because our own annual tests prove that they give far better service in every application," says Mr. Harold Twigg, finishing department superintendent, The Foxboro Company, Foxboro, Massachusetts.

"An example is the polishing of the doors of this instrument case. In our production run tests this year, our standard was 180 pieces per belt on the first rough cut. The Armour belt polished 225 pieces. Another example is the finish cut. Our standard is 100 pieces per belt. The Armour belt polished 125," he reports.

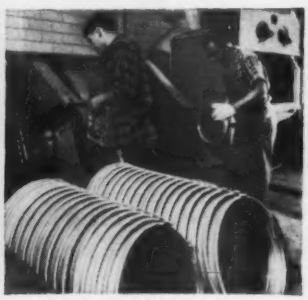
Production standards at Foxboro are the result of years of accumulated experience. And, like other leading manufacturers throughout industry, Foxboro's experience leads them to choose Armour Coated Abrasives for extra performance.

How long has it been since you've tested Armour Coated Abrasives? Our standing offer is—put Armour to work on your toughest, most demanding job. Then look at the improved results—more production, higher quality, less cost.

There is an Armour Coated Abrasive distributor near you. He's ready and willing to meet your most strict requirements. And he's backed by Armour technical help and more than sixty years' growth in coated abrasives technology. If you'd like a detailed technical report on The Foxboro Company's experience, write for data sheet M-100, Armour Alliance Industries, Coated Abrasives Division, Alliance, Ohio.



Precision "movement" parts are fed through grinder. Door normally closed is open to show Armour Abrasive belt. Armour Abrasives help The Foxboro Company maintain their standard "piano" finish of a fine concert grand.



Armour Coated Abrasives used in polishing die cast door and ring. Both are components of cases which protect precision Foxboro instruments against adverse conditions in chemical plants, paper mills and oil refineries.

the new Armour and Company

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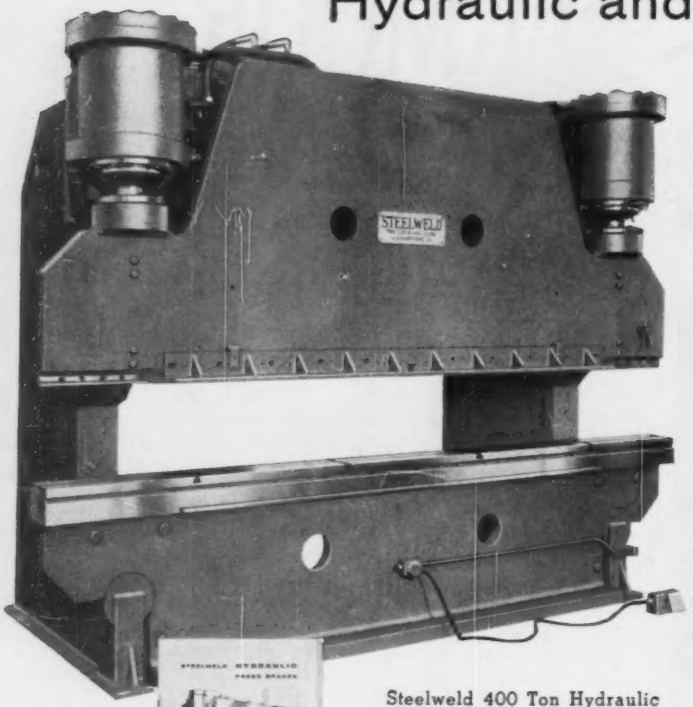
STEELWELD PRESS BRAKES

Hydraulic and Mechanical



WHATEVER your requirements, there is a Steelweld Press Brake —hydraulic or mechanical—to best serve your needs. Available in all sizes to 2000 tons. For plate thicknesses to 2". For lengths to 30'-0".

Each type of machine, mechanical or hydraulic, has its particular advantages. The work to be performed is the determining factor for most satisfactory machine selection.

As a manufacturer of both types of press brakes, we are in a position to offer you either one without partiality. Therefore, we urge you to get the complete story, the Steelweld story, when considering the purchase of a new brake. Ask for free catalogs.

Steelweld 400 Ton Hydraulic Press Brake. Bed and ram length 14'-0".

Steelweld 320 Ton Mechanical Press Brake. Bed and ram length 12'-2".

Hydraulic Press Brakes
Catalog No. 2024

Mechanical Press Brakes
Catalog No. 2023

STEELWELD
Mechanical and Hydraulic
PRESS BRAKES

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

THE CLEVELAND CRANE & ENGINEERING CO. • 1475 EAST 281st STREET • WICKLIFFE, OHIO

Stokes Licenses Scottish Firm To Make Its Vacuum Equipment

Under an agreement with F J Stokes Corp, Philadelphia, the firm of Vacuum Industrial Applications Ltd, Wishaw, Lanarkshire, will produce Stokes-designed vacuum induction melting furnaces and vacuum stream-degassing systems.

VIA Ltd is a member of the Lithgow Group, a holding company which includes among its several other subsidiaries one of Scotland's major shipbuilding concerns and employs in all more than 14,000 workers. VIA is one of the foremost combinations of vacuum specialists in the United Kingdom and has already produced the largest vacuum furnace thus far built in Europe.

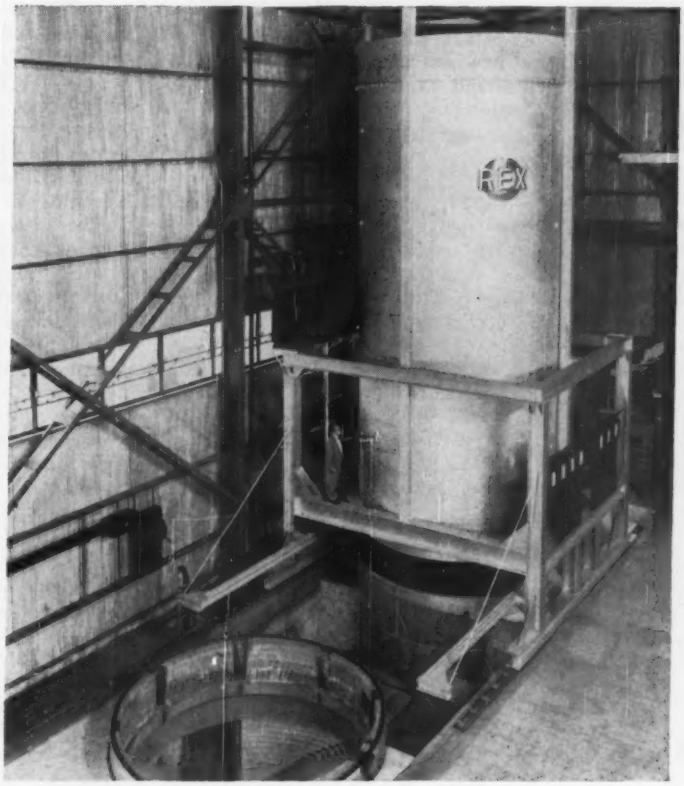
Pesco Buys Harnischfeger Line

Harnischfeger Corp, Milwaukee, has sold exclusive manufacturing and sales rights on P&H welding positioners in continental US to Pesco Inc, Pittsburgh. Marketing will be done under a new tradename, Pesco-P&H. The positioners will continue to be sold through Harnischfeger's Welding Products Division as well as additional sales outlets to be determined by Pesco.

Perkins Machine Takes Over Precision Gears Line

Perkins Machine & Gear Co, West Springfield, Mass, has acquired the entire inventory of standard stock spiral bevel gears from Precision Gears & Products Inc, Paterson, NJ, which has recently discontinued the manufacture and sale of these parts. Purchase includes finished stock and engineering specifications.

Acquisition, together with the one made in 1960 from the Gleason Works of Rochester, NY, now makes Perkins the largest manufacturer and distributor of this type of gear in the country.



Huge, electrically heated heat-treating furnace at J W Rex Co, Lansdale, Pa, is large enough (inside dimensions: 32 ft high, 12 ft dia) to handle parts for the Nova moon rocket. Maximum temperature is 1850 F. The 42-ft-deep pit directly below the furnace is used for tempering (up to 1250 F), or as a loading station, or for forced-air quenching. Pit in foreground is used for air, oil, or salt quenching. Unit is equipped with automatic atmosphere and temperature recording controllers

Ipsen's New Division Studies Ultra High-Temp Materials

A program designed to step up technological research into the fabrication and processing of ultra high temperature materials has resulted in the formation of a new subsidiary of Ipsen Industries, Rockford, Ill, manufacturer of heat treating equipment.

The Refractory Metals Division, located in Rockford, will house the latest scientific apparatus relative to the production of refractory metal structures, thermal coatings, and ceramic components for use in aircraft and missile applications. Special emphasis will be placed on the

McGIRK'S WORKS

OVER AT THE FACTORY, MY HUSBAND MACHINES 500 SEPARATE PARTS A DAY, AND EACH ONE HAS TO BE TOOLED DOWN TO 10,000th OF AN INCH!
THAT'S VERY PRECISE ISN'T IT?
IT CERTAINLY IS.
MOE'S CORNER
That Genius character is really stupid. He even thinks a screwdriver is some kind of a tool!

research and development of materials working temperatures of which exceed 3000 F. These include not only the processing of such metals as tantalum, columbium, tungsten, molybdenum, and rhenium, but also the investigating of new solid coating systems to withstand temperatures of 3500 F or better.

Kerns United Corp Forms Canadian Company

Formation of a new Canadian company, Kerns Lubricants Ltd, is announced by Kerns United Corp, Calumet City, Ill, producer of specialized industrial lubricants. The Toronto firm will operate as an independent company using Canadian manufacturing facilities and materials to turn out the Kerns line. Bruce W Glenn, who has been appointed president of KL Ltd, was formerly vice president, sales, for Kerns United.

AMF Acquiring Thermatool

American Machine & Foundry Co and New Rochelle Thermatool Corp have signed an agreement for the acquisition by AMF of Thermatool's assets in exchange for AMF common stock. Thermatool is engaged in the development and licensing of electrical welding systems.

$4 Million Order to Avco

Army Ordnance contract has been received by Avco Corp's Electronic and Ordnance Division. Of the total amount, $2.3 million will be for production of classified ammunition and the remaining $1.8 million is earmarked for new facilities at the company's plant in Richmond, Ind. The firm is hiring approximately 375 additional workers as a result of the new contract.

Zagar Acquires Line

Zagar Inc, Euclid, Ohio, machinery builder, has concluded arrangements with Central Engineering Co of Racine, Wis, to take over the latter firm's line of high-speed centering machines. Zagar will assume design, manufacturing, and distribution responsibilities and intends to improve and enlarge the present line.

L-T-V's Plasma Arc Facility Produces Temps to 25,000 F

Ling-Temco-Vought Inc has installed a unit in a new nuclear research lab recently opened that'll be used to test materials under conditions a space ship encounters in re-entering the earth's atmosphere. The device will also be used for development of new types of nose cones and coatings for heat-resistant materials; development of new types of high-temperature instruments; conversion of plasma energy into electrical energy for space motors; and for study of space thrust devices.

L-T-V believes the plasma arc, coupled with a highly precise optical spectograph provides the firm with one of the most advanced high-temperature research facilities in the aerospace industry. The spectrograph will help scientists analyze the composition of the plasma stream and obtain data on the electrons and ions and their concentrations. They can obtain temperature measurements of a plasma stream which would instantly vaporize conventional heat-measuring instruments. The new lab also includes a 3-million volt Van de Graaff accelarator, or atom smasher.

Diamond Application Lab Set Up by General Electric

A new Diamond Application Development Laboratory facility has been put into operation by the Metallurgical Products Department of GE in Detroit. Facility has been set up to investigate new and improved diamond applications; to evaluate new GE man-made diamond types; and to analyze comparative performance testing operations.

The lab is equipped with a variety of standard grinding machines with special modifications to permit accurate control of the many variables which affect diamond performance.

"Of course nobody showed up for work, Mr. Duncan; at the plant party you told everybody to take a week off with pay!"

ASARCON

DISTRIBUTORS for ASARCON CONTINUOUS-CAST BRONZE:

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MARKET 2-6330
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HILLCREST 2-2086
NEW YORK
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Buffalo
Kencroft Associates, Inc.
RIVERSIDE 1520
Rochester
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HAMILTON 6-1630
Syracuse
Meloon Bronze Foundry, Inc.
GLENVIEW 4-3231
Troy
The Troy Belting & Supply Co., Inc.
AS 2-4920 (in Albany 3-6121)
OHIO
Akron
Akron Welding and Spring Co.
JEFFERSON 5-2187
Cleveland
Copper & Brass Sales, Inc.
VU 3-4100
The Bearing Bronze Co.
MICHIGAN 1-6520
Cincinnati
Reliable Castings Corp.
KIRBY 1-2627
Columbus
Williams & Co., Inc.
AXMINSTER 4-1623
Dayton
The Bristol Brass Corp. of Ohio
BALDWIN 8-8185
Toledo
The Seegar Brass Company
CHERRY 8-5321
Williams & Co., Inc.
GREENWOOD 5-8661
PENNSYLVANIA
Easton
R. T. Schaller Co.
BL 2-2435
Latrobe
Latrobe Foundry Machine & Supply Co.
KEYSTONE 7-3341
Philadelphia
Brass & Copper Sales, Inc.
GLADSTONE 7-2500
Renewal Service, Inc.
BALDWIN 9-6330
Pittsburgh
Pennsylvania Industrial Supplies Co., Inc.
ALLEGHENY 1-5010
Pittsburgh Brass Mfg. Co.
ATLANTIC 1-8761
RHODE ISLAND
Providence
Clifford Metal Sales Co., Inc.
UNION 1-4100
SOUTH CAROLINA
Greenville
J. M. Tull Metal & Supply Co., Inc.
CEDAR 3-8366
TENNESSEE
Memphis
Memphis Bearing & Supply Co.
JACKSON 6-7543
Nashville
Dixie Bearings, Inc.
CHAPEL 2-7351
TEXAS
Beaumont
Standard Brass & Mfg. Co.
TERMINAL 3-2641
Houston
Standard Brass & Mfg. Co.
RI 7-1220
Port Arthur
Standard Brass & Mfg. Co.
YUKON 5-9377
WISCONSIN
Milwaukee
Badger Bearing Co.
BROADWAY 2-0231
CANADA
Lachine, Quebec
Federated Metals Canada, Ltd.
MELROSE 7-3591
Scarborough, Ontario
Federated Metals Canada, Ltd.
PLYMOUTH 7-3246

CIRCLE 395 READER SERVICE CARD

ASARCON

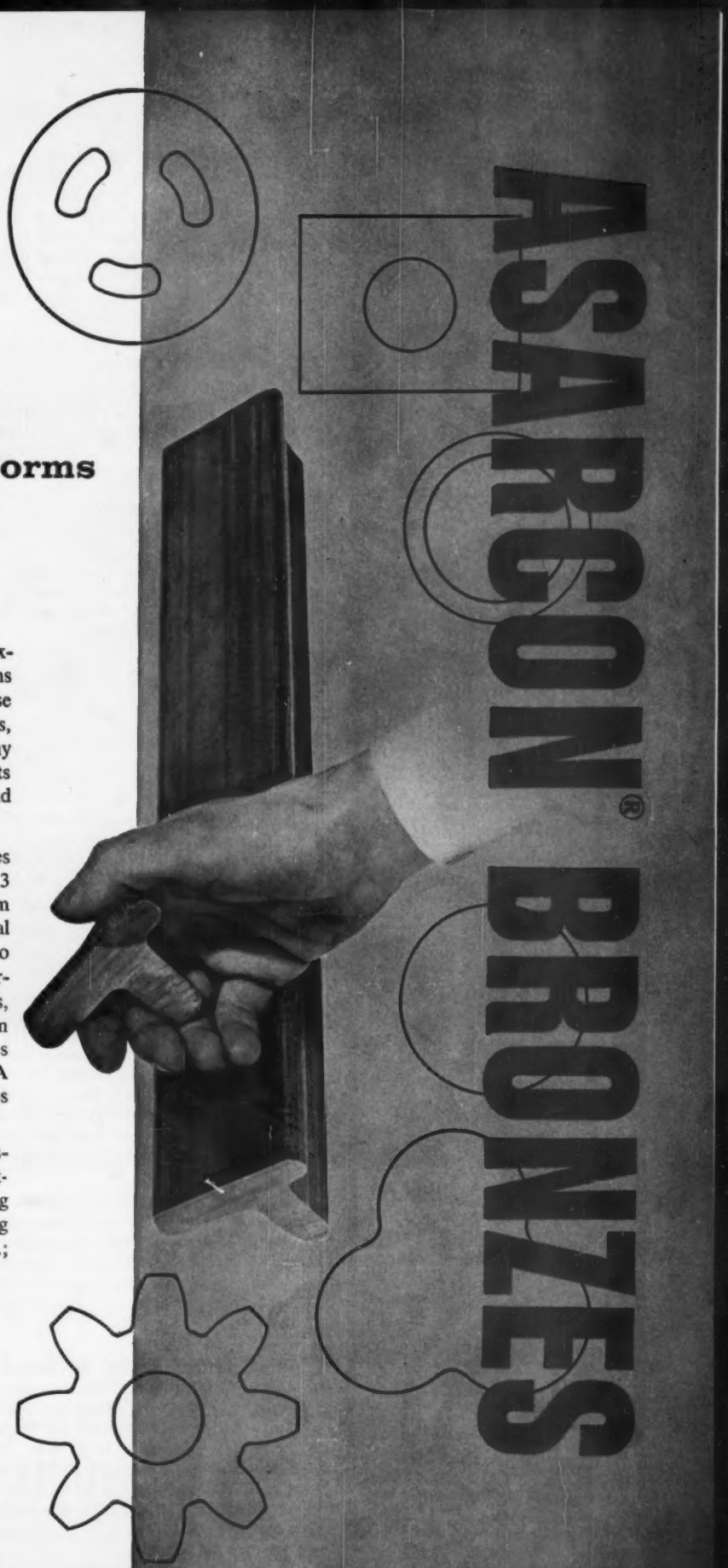
custom shapes and forms in any lengths you need

Asarcon continuous castings give you an extremely wide variety of shapes and forms in standard bronze alloys. They will increase your production rates and lower your costs, because: you get the shape you want in any length you need up to 20 feet. This permits machining on automatic screw machines and other high-speed equipment.

Continuous casting of Asarcon bronzes raises fatigue characteristics of standard alloys 33 to 100%, increases impact strength from 15% to more than double that of identical alloys cast other ways, adds materially to tensile, yield strengths and hardness. Asarcon 773 (SAE 660) bearing bronze in solids, rods and tubes is immediately available from stock in your choice of more than 260 sizes up to 9″ O.D. and lengths up to 105″. A wide variety of other special alloys, shapes and sizes produced to order.

For complete data on Asarcon continuous-cast bronze, write Continuous-Cast Department, American Smelting and Refining Company, Perth Amboy, N. J.; Whiting Ind., or 120 Broadway, New York 5, N. Y.; or call your nearby Asarcon distributor.

ASARCO



CIRCLE 396 READER SERVICE CARD

the right punch & die at your finger tips...

NEW DI-ACRO PUNCH PAKS

Punch Pak No. 1 - $139.50
Punch Pak No. 2 - $259.50

- **Off the shelf delivery**
- **Adapters to fit any punch press**

Di-Acro Punch-Paks save you money, cut production delays. No time lost looking for the right size or waiting for special orders. Cost is approximately 10 per cent less than individual punch and die sets—with the rugged, steel store-or-carry chest free. All Di-Acro Punches and Dies are precision made of quality tool steel.

PUNCH-PAK NO. 1 contains 30 sizes of round punches and dies from 3/64" to ½" in increments of 1/64".

PUNCH-PAK NO. 2 contains round punches and dies from 1/16 to ½" in 1/16" increments, round sizes from ½" to 2" in ⅛" increments, squares in ½", ⅝", ¾" and 1" sizes, one die holder and two die adapters.

Die Adapter A-2 ¾" diameter—1¼" bore, Die Adapter B-2 ¾" diameter—2⅛" bore.

DIMENSION DATA

All Di-Acro Punches to ½" have ½" diameter shanks, 2 13/32" length.
All Di-Acro Punches from ½" to 2" have 1" diameter shanks, 3⅛" length.
All Di-Acro Dies to ¾" are 1¼" diameter, ⅝" high.
All Di-Acro Dies from ¾" to 1⅜" are 2⅛" diameter, ⅞" high.
All Di-Acro Dies from 1½" to 2" are 2¾" diameter, 15/32" high.

PUNCH AND DIE HOLDERS

which adapt Di-Acro Punches and Dies to any punch press are listed in literature on single station punch and die program. Ask for it . . . also for literature on new Adjustable Punch and Die program.

For full information consult Yellow Pages of your phone book under Machinery-Machine Tools for the name of your Di-Acro distributor or write us.

Pronounced die-ack-ro

di-acro PRECISION METALWORKING EQUIPMENT

DI-ACRO CORPORATION
formerly
O'Neil-Irwin Mfg. Co.
2112 Eighth Avenue
Lake City, Minnesota • U.S.A.

FIELD REPORT

Among investigative projects currently under way are 1) evaluation of GE man-made diamond grinding hardened steels; 2) determination of the feasibility of using diamond in plate glass grinding; and 3) evaluation of the performance of manufactured diamond in blades for masonry cutting applications.

Lang Tool Acquired By Laminated Shim

Laminated Shim Co, Glenbrook, Conn, manufacturer of Laminum (registered name for laminated shims of titanium, aluminum, stainless, brass, and mild steel) has taken over Lang Tool & Manufacturing Co of Glendale, Calif. The Lang plant will continue to produce electric motor laminations, also generator and transformer laminations, and will carry on as a prime supplier of carbide tooling.

Expansion in Northern Calif

More than $166 million was committed for industrial expansion in northern California during the first eight months of this year, according to the San Francisco Chamber of Commerce. Of the total, $140.1 million went for 517 plant expansions and $26 million for 221 new factories.

7-Year Lease Plan Introduced By Verson Allsteel Press Co

New seven-year lease plan for its complete line of press brakes, hydraulic presses and shears has been developed by Verson. Leases are available for as little as $10,000 worth of equipment. Previously, lease plans were for a maximum of five years; these will still be available. Low-cost renewal options are standard and purchase options are also available to firms which desire them.

Cleveland Pneumatic Industries . . .

. . . is considering a merger into Pneumodynamics Corp, its publicly held subsidiary. Such a merger would bring together two companies with combined annual sales of $45 million.

Grand Central Rocket Re-Named

Grand Central Rocket Co, Redlands, Calif, manufacturer of solid propellants, which was acquired by Lockheed last August, will now be known as the Lockheed Propulsion Co. Robert F Hurt has been named president of the Propulsion subsidiary.

Bendix Acquires Interest In German Air Gage Firm

A one-third interest in Nieberding & Co GmbH of Neuss, Germany, has been acquired by Bendix Corp. Nieberding is a leading European manufacturer of pneumatic gaging equipment for industry.

Licensing agreements have also been concluded between the two firms whereby the German company will manufacture the complete line of precision air gages of the Sheffield Corp, Dayton, Ohio, subsidiary of Bendix. It'll also handle sales of Sheffield's precision measurement instruments, automatic gaging and assembly machines, and machine tools in Germany, Austria, and Denmark. Production tooling for manufacture of Sheffield air gaging equipment is under way at Nieberding and the company will develop facilities on a graduated basis for production of other Sheffield equipment.

$6 Million Order Goes to Bell Helicopter

Contract for procurement of an Army light observation helicopter has been awarded to Bell, Fort Worth, Texas. The craft called for by the contract are Bell's entry in a three-company contest that could reward the winner with substantial production orders.

Bell and two other firms were chosen earlier this year as winners of LOH design competition. The others are Hiller Aircraft of Palo Alto, and Hughes Tool Co's Aircraft Division of Los Angeles. Hiller and Hughes have been awarded contracts comparable to Bell's.

AM/MM

"Your paycheck may still be a little wet, Charlie. The boss was crying when he signed it."

Test it yourself and see. AO "Fyre-Free" meets ASA requirements for flameproofed fabrics. It may smoke, but will not support combustion.

Use it against sparks or light metal splash . . .

AO "Fyre-Free" Clothing Won't Support Combustion

Take any job in the plant with exposure to heavy sparks or light metal splash . . . that's the place for AO "Fyre-Free" protective clothing. Treated with a permanent type of flameproofing, "Fyre-Free" won't smolder — no after-flame or afterglow. It can be washed as many as ten times and still come back for more because the flame-resistant properties stay with it.

This 100% cotton cloth is light in weight . . . with good tensile strength in both warp and fill . . . yet it has the soft feeling of untreated fabric that workers like. "Fyre-Free" clothing is mildew-resistant, does not deteriorate in damp climates or operations.

You can get a full line of "Fyre-Free" coats, pants, coveralls, overalls, sleeves, cape sleeves, aprons and bib leggings. For details and prices, consult your AO Safety Products Representative.

Your Surest Protection . . . AO SURE-GUARD Clothing

American Optical
COMPANY

SAFETY PRODUCTS DIVISION • SOUTHBRIDGE, MASSACHUSETTS

Now Danly engineering pierces more fender skirts with one!

It took three separate presses to pierce 62 mounting holes and shear pairs of inner fender skirts for a major automobile maker. Then Danly engineers were invited to cut costs. And they did! They designed this up-acting mechanical press with built-in hydraulic piercing units to do the job better and faster. It's engineered to turn out 600 fender skirts per hour—considerably more than the three presses it replaced! Much more economically, too, because it also eliminates two sets of complex cam type piercing units and the automation between the presses. Greatly reduces labor costs and floor space requirements, too.

The solution to this problem of how to accomplish these many operations on an irregularly-shaped piece of metal required broad experience in mechanical press, hydraulic press and hydraulic piercing equipment design—plus a good deal of imagination. This made the job a "natural" for Danly because, in each of these areas, Danly engineers are known to excel. Perhaps you, too, have a press problem that's a natural for Danly engineers. Shall we discuss it?

DANLY

NEW ENGINEERING BULLETIN
—tells just what this mechanical-hydraulic press does—and how it does it. Write for your copy.

Mechanical Presses, Die Sets, Diemakers' Supplies, Hydraulic Metalworking Equipment

DANLY

DANLY MACHINE SPECIALTIES, INC., 2100 South Laramie Avenue, Chicago 50, Illinois

FIELD REPORT

Infrared Buys Simpson Optical

Infrared Industries Inc of Waltham, Mass, said to be the world's largest producer of infrared detectors, has acquired Simpson Optical Manufacturing Co of Chicago. The 35-year-old precision optics firm will be operated as the Simpson Optical Co, a division of Infrared. A proprietary development of Simpson, VERNAC, is widely used in the machine tool field for direct-reading precision measurements by optical means.

New Lockheed-Georgia Plant

Lockheed-Georgia Co, Marietta, has leased a plant in Clarksburg, West Va, to be used for subassembly. According to President W A Pulver, the action "supports the federal government's interest in placing defense work in areas of economic distress." The facility will turn out subassemblies for the C130 military transports being produced at Marietta. Training of an estimated 200 new employees will start this month; first deliveries from Clarksburg are expected next March.

Feralloy Opens in Baltimore

Chicago - headquartered Feralloy Corp, a major processor and distributor of ferrous and non-ferrous metals, has established a facility in Baltimore, called Feralloy Eastern Corp. It'll function as a metal slitting and shearing service for producers of electric welded tubing, automotive and general stampings, tail pipes, and mufflers.

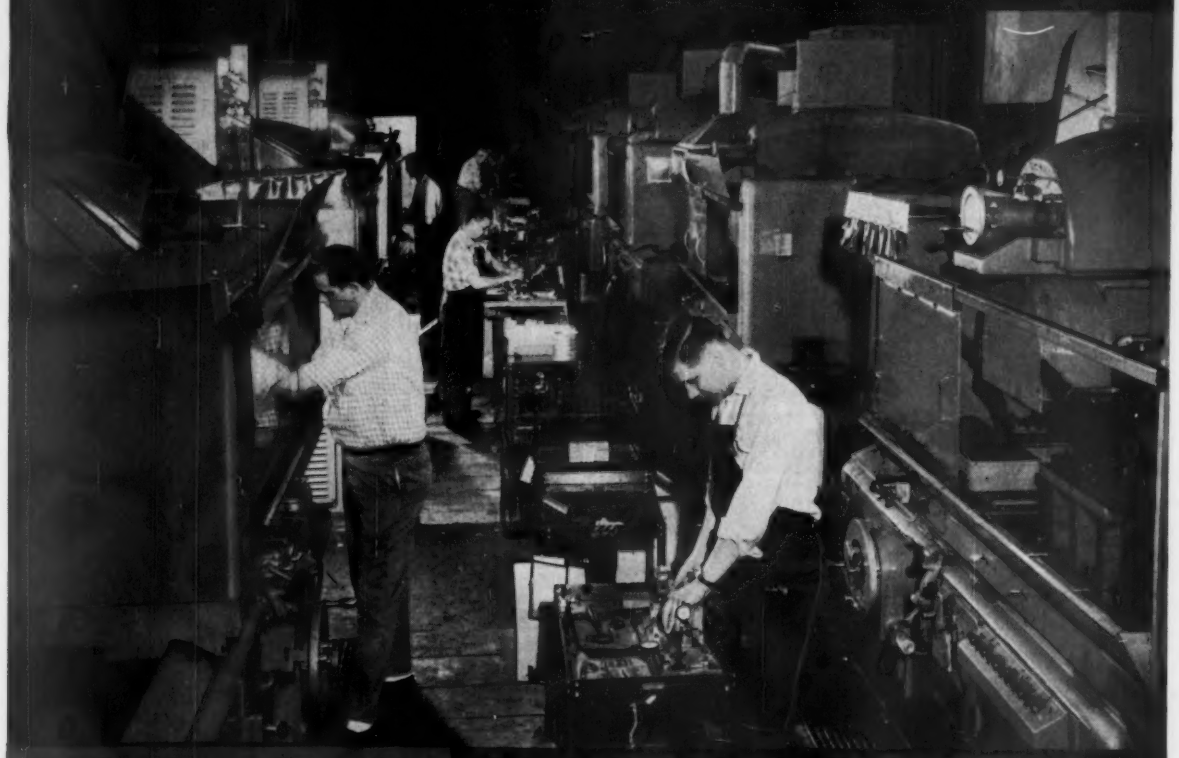
"Not going to lunch—trying to lose some weight . . ."

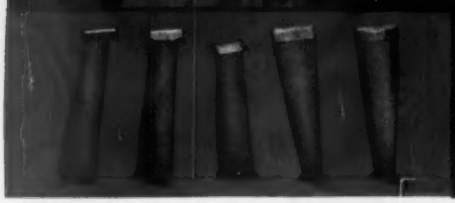
◄ CIRCLE 399 READER SERVICE CARD

This well-known manufacturer depends on . . .

A BANK OF THOMPSON GRINDERS

. . . for a tough production job.





THOMPSON RAMO WOOLDRIDGE INC. picks Thompson Grinders for accuracy, dependability and speed.

All the Thompson machines shown above in one bank are grinding jet aircraft engine compressor vanes. Each of the 5 surfaces on the root end as well as the concave and convex airfoil surfaces on the lug end are ground to extreme accuracy on the stainless steel forgings.

For the five years that these Thompson machines have been steadily on this job, downtime and maintenance costs have been negligible factors.

Put your toughest production job on a Thompson grinder and watch it cut your costs, speed your production and improve your product.

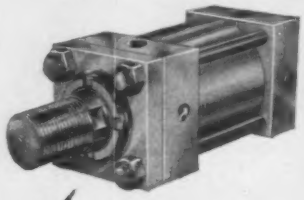
THE THOMPSON GRINDER CO. Springfield, Ohio

"Keep [illegible] *in mind for that daily grind"*

Thompson SURFACE GRINDERS

A-O-K

AIR and HYDRAULIC
CYLINDERS
and
BOOSTERS



A-O-K Speed
A-O-K Performance
A-O-K All Sizes
A-O-K All Styles
A-O-K All Pressures (Standard up to 3000 psi.)
A-O-K Prompt Delivery
A-O-K Engineering Service

Find us fast in the 'Yellow Pages'

Call or Write

A-5520A

The S-P Manufacturing Corp.
A BASSETT COMPANY
ESTABLISHED 1916
30201 Aurora Road • Cleveland 39, Ohio

FIELD REPORT

Umbaugh Florida Bound

A Hagerstown, Md, gyroplane manufacturer, Umbaugh Aircraft Corp, is moving to Bartow, Fla, under a 25-year lease agreement with the city. Company will operate in six buildings at the municipal airport. Lease, which calls for employment of at least 500 persons within 18 months, also calls for operation of the airport as a public facility with the company furnishing all services of a fixed base operator.

Gairing Tool Bought By Waukesha Cutting Tools

Acquisition of the product line of Gairing Tool Co, Detroit, by Waukesha Cutting Tools Inc of Waukesha, Wis, includes entire product inventory, all tools, dies, fixtures, special tool machines, and other basic equipment. The entire line of eight basic products including spade drills, boring cutters, and boring bars, will be manufactured by Waukesha.

Railiner Inc . . .

. . . is a new Haleyville, Ala, firm which will make piggy-back equipment for rail and highway transportation. The city of Haleyville has sold $625,000 in bonds for a plant to house Railiner and has signed a 20-year lease with the firm. Construction is currently underway and full employment is estimated at 500.

Berry Building in Miss

Berry Hydraulics, hydraulic pump producer, and a wholly owned division of Oliver-Tyrone Corp, plans to put up a 53,000 sq-ft facility in Corinth, Miss, which will double the floor space of the present Berry operation there.

Sangamo Expands in SC

A new 150,000 sq-ft plant will be built at Walhalla, SC, by Sangamo Electric Co which is also making a 65,000 sq-ft addition to its Pickens, SC, works. The $5 million facility will manufacture electronic capacitors and is expected to have an ultimate employment of 600.

$2.5 Million Plant for Atlanta

Republic Transcon Industries Inc, Los Angeles, expects to employ 500 workers in a new plant to be put up in Atlanta. It'll manufacture water heaters, air conditioners, and outdoor signs; operations are scheduled to get underway in April. •

When you build new machines or rebuild old equipment you can SAVE MATERIAL, TIME, LABOR, MONEY with

COES MICRO-WEAR STRIPS

Master scraping plate at Norton Company with Micro-Wear Strips.

Micro-Wear Strips Applied to the cross slide on the knee of a milling machine.

These are just two of the many applications that help reduce the manufacturers' original cost.

These strips are uniformly hardened to minimum 64 Rockwell C hardness and can be manufactured to your exact specifications, ready for application with Coes #945 Epoxybond adhesive or with holes for hold-down screws.

Send for latest technical information

COES
KNIFE COMPANY
68 COES ST.
WORCESTER, MASS.

COES MICRO GROUND

NIKON OPTICAL COMPARATOR

new model 3A offers unusual screen brightness and image resolution – features zoom-condenser system

The unusual image brightness, definition and accuracy achieved in the new model 3A—to the very edge of the screen—is a credit to the quality and design of its optical system.

The new Nikon model 3A permits surface as well as contour inspection—independently or simultaneously. And controls are provided for adjusting the intensity of each of the illuminators.

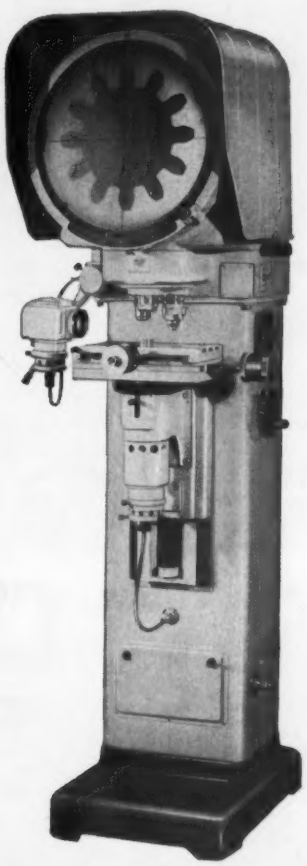
The surface illuminator may be used obliquely to emphasize surface texture. Or, for greater measurement accuracy, the surface illuminator may be used in conjunction with lens-mounted, half-reflecting 45° angle mirrors to provide shadowless light on the optical axis. Contour illuminator employs a special zoom condenser matching system. Convenient control simplifies adjustment for optimum illumination at each magnification.

Model 3A is normally supplied with a choice of one or more standard lenses in magnifications ranging from 10x to 100x. Other magnifications are also available on special order. A 3-lens turret supplied as standard equipment, facilitates instant changes. Focusing is smooth and effortless. Utilizes leadscrew drive with scraped ways and adjustable gibs.

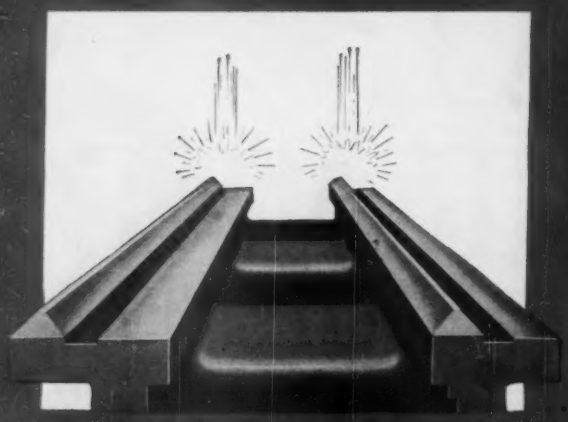
The model 3A is equipped with a sliding hood which may be drawn out to shade the screen, or can be retracted to permit ready access to chart or screen surface. The overall diameter of the screen glass is 14½", designed for use with standard charts.

The new Nikon 3A accepts a wide variety of micrometer stages, holding fixtures, protractor screens, charts, photo attachments, and other accessories. For details write to Dept. AM 12

features new 14" screen



NIKON INCORPORATED Instrument Division 111 Fifth Avenue New York 3, N. Y.



FLAME HARDENED BED WAYS

..Standard on all Clausing lathes

Flame hardening of all four bed ways—which adds years to accuracy life, increases stability and rigidity—is but one "no-extra-cost" feature contributing to Clausing's reputation for superior performance and value. Here are some others:

"Zero-Precision" Timken tapered roller bearings; L-00 tapered key-drive; forged steel spindle; crown shaved gears; automatic apron with oil bath lubrication. There are many more—not the least of which is surprisingly low price.

Get the complete story from your dealer on Clausing 12" lathes—engine, tool room, turret and hydraulic. And write today for catalog.

CLAUSING

DIVISION OF ATLAS PRESS COMPANY

12-102 N. PITCHER ST., KALAMAZOO, MICHIGAN

vision which manufactures automatic packaging, package handling, and forming machinery. He joined the Emhart corporate staff in July as manager, products and market planning.

Ford Motor Co has appointed **Walter Johnson** general manufacturing manager of the Transmission and Chassis Division. Formerly manager of the Canton, Ohio, forge plant, he succeeds **John B Lawson** who has been named director, administrative and manufacturing Staff at Ford's Aeronutronic Division at Newport Beach, Calif

Wheel Trueing Tool Co, Detroit, has elected **Leo Catallo** a vice president of the firm. He has been factory manager since 1959 and will continue to be in charge of product development and engineering

Crescent Tool Co, Jamestown, NY, has elected **Alaric R Bailey** president. He will also serve as a vice president of **Crescent Niagara Corp** of Buffalo, parent company. Mr Bailey was formerly vice president of Rockwell Manufacturing Co and general manager of its Automatic Voting Machine Corp Division.

American Radiator & Standard Sanitary Corp, Buffalo, has named **Myrle R Husted** manufacturing superintendent of the stamping plant.

WHEN DRILLING GETS TOUGH!

NEW **JARVIS**

RED-DOT DRILLS

● **HEAVY DUTY**

● **SOLID CARBIDE**

Made especially for hardened steels to Rockwell C-65; high temperature and high tensile alloys to C-56. For high production on exotic space metals. Removes stock faster, lasts longer than ordinary drills. Maximum rigidity and strength, yet precisely ground for extreme accuracy. Economical to resharpen. *Priced in line with standard Carbide Drills. All sizes made in full standard drill lengths.*

WITH **JARVIS**

SOLID CARBIDE TOOLS

SAVINGS START WITH THE FINISH!

***(Plus The Advantage of Dealing With a Jarvis Agent)**

WHY SAVINGS START WITH THE FINISH

A high finish on the tool means it will last longer . . . longer life reduces tool costs. A high finish on the tool means a superior finish to the work . . . better results, greater production, a savings in time.

HOW HIGH FINISH IS OBTAINED

Painstaking care is taken in the manufacture of Jarvis Solid Carbide Tools. For example, particular attention is paid to assure the correct fluting and relieving. Tests and inspections are exacting. This makes for keener cutting edges, greater accuracy, high finish. The Jarvis policy of insistence on the ultimate in quality is your insurance of both economical and reliable tool performance.

***ADVANTAGES OF DEALING WITH JARVIS AGENTS**

The factory trained Jarvis agent gives your carbide tool problems his undivided, personal attention. Representing but a few lines, he is better informed, more capable of recommending the right tool for the job. This *knowledgeable* service helps you to get *economical* and *superior* carbide tool performance. Call in your Jarvis agent and sound him out!

JARVIS WAREHOUSES IN ALL KEY CITIES

SEND FOR *NEW* CARBIDE CATALOG

Jarvis CORPORATION

• End Mills • Boring Tools
• Reamers • Drills • Key Seat Cutters
• Duplicating Cutters • Rotary Files
• Countersinks • Boring Bits

JARVIS COPORATION, 40 Lynnway Lynn, Mass.

....Have Agent Call ....Send Carbide Catalog

Name ..... Title .....

Company .....

Street .....

City & State .....

New . . . Model 1A

LINLEY

JIG BORING MACHINE

Improved Accuracy For Precision Toolroom Work

The new Linley Jig Boring Machine has many features insuring greater accuracy that are usually found only on the higher priced machines. The entire table and saddle assembly has been greatly increased in size and weight for more rigidity and improved balance characteristics. Precise opefation is assured through the use of square edged ways with positive no-shift table and saddle locks.

Table size and movement are 7" x 17½" and 6½" x 10" respectively. Guaranteed lead screw accuracy, one ten thousandths over entire range.

Send for full details, price.

LINLEY BROTHERS CO.
664 State Street Ext.
Bridgeport 1, Conn.

NAMES IN THE NEWS

Van Norman Industries has elected **Paul C Eberhardt** (top) executive vice president of the **Super Tool Co Division,** Elk Rapids, Mich. He had been vice president, manufacturing and engineering for Van Norman. **Donald H Thure,** works manager of the company, has been elected executive vice president and general manager of the **Bingham Stamping Division,** Toledo

Waldes Kohinoor Inc, Long Island City, NY, has elected **Dr Harry K Waldes** (top), chairman of the board. He will continue to serve as executive vice president. **George Waldes,** formerly vice president, sales and production, has been elected president

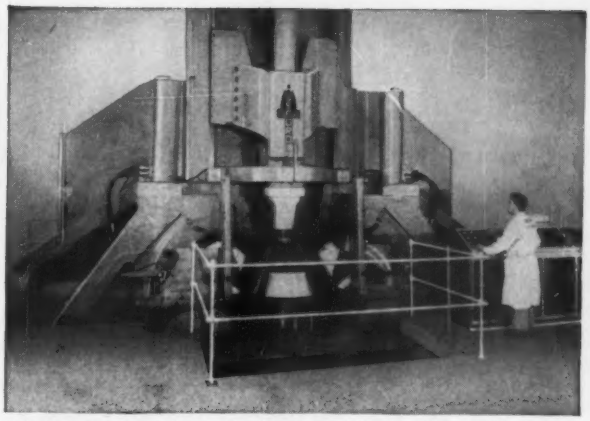
Burgmaster Corp, Gardena, Calif, has elected **Norman Ginsburg** executive vice president. He was formerly vice president and treasurer

Engelhard Industries Inc, Newark, NJ, has named **Charles E St Thomas** a senior vice president. He will join the precious metals corporation Jan 1. Mr St Thomas now is president of St Thomas Associates, New York and London management consulting firm

American Bosch Arma Corp has appointed **Hans Hogeman** manager of engineering for **American Bosch Division,** Springfield, Mass. He was formerly assistant manager of engineering, fuel injection products.

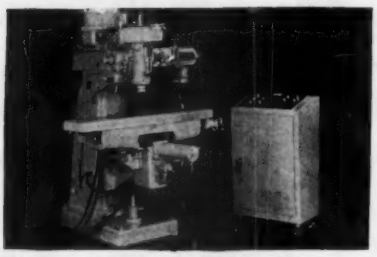
Ajax Magnethermic Corp, Youngstown, Ohio, manufacturer of induction heating and melting equipment, has named **R S Segsworth** chief engineer for the Trenton, N.J. Division. •

ACCEPTED ACCURATE AUTOMATIC

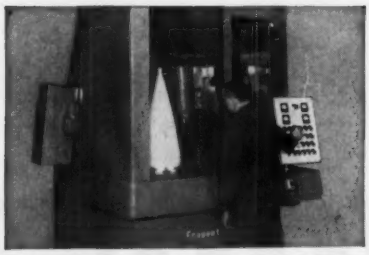


Hufford Corporation spin forge machine with *two* Honeywell 360° Tracer Control Systems plus spindle speed control.

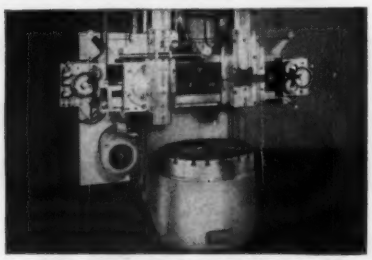
HONEYWELL ELECTRO HYDRAULIC TRACER SYSTEMS



Gorton Vertical Milling Machine equipped with Honeywell 360° Electro Hydraulic Tracer Control System.



Frauenthal vertical contour (radome) grinder with Honeywell Electro Hydraulic Tracer Control System.



Giddings & Lewis Vertical Mill with two Honeywell 360° Electro-Hydraulic Tracer Control Systems.

Now operating on a wide variety of well-known machine tools (some of them illustrated at the left), Honeywell 180° and 360° Tracer Control systems provide fast, accurate and reliable system response for smooth application of large increments of hydraulic power.

They combine the flexibility, remote control and finesse of electronics with the power and fast actuation of hydraulics. They're far more flexible than completely hydraulic systems. These systems have been designed for ease of application. Modular construction simplifies and speeds field service.

ACCURACY—Accuracies of + .0005″ from template to part and + .0002″ from part to part have been achieved in actual use.

ADAPTABILITY—These systems are now in operation on all types of machine tools, from light duty engine lathes to huge spin forging machines. Every application is custom fitted—at production line prices.

PERFORMANCE—Each Honeywell system becomes an integral part of the machine tool. The control system can be adjusted to compensate for changes in machine performance during the life of the machine. Speed range of 300 to 1 is normal; greater rangeability is available on some applications. Tracing speed ranges up to 60″ per minute are available.

For further information on Honeywell's new machine control systems and components and their application to your specific job, contact Minneapolis-Honeywell, Machine Control Group, Dept. AM-12-61, Minneapolis 8, Minnesota. *Sales and service offices in all principal cities of the world.*

Honeywell

H HONEYWELL First in Control

EVALUATE MAR PENETRATION WHERE IT COUN AND

YOU'LL

DECIDE THIS

METALWORKIN MOST POWERF SELLING TOOL

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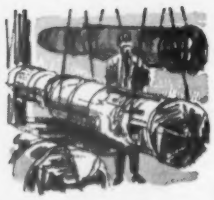

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In metalworking—men who matter read...

American Machinist / ***Metalworking Manufacturing***

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, N. Y.

There are 21 basic manufacturing industries in the U.S. Government's Standard Industrial Classifications. Eight of them make up metalworking—the manufacturing of products from metal—and American Machinist/Metalworking Manufacturing concentrates its circulation (all ABC paid, incidentally) in these eight. An executive responsible for mining, ore-producing, or refining operations—or in any industry not involving metal*working*—is almost automatically excluded as a potential reader by his lack of vital interest in the subjects covered editorially by AM/MM.

AM/MM's circulation is centered in key metalworking plants in key metalworking states and is growing steadily in all eight divisions of metalworking.

Because AM/MM is read by men—manufacturing managers, manufacturing engineers and plant managers—whose sole business is making things of metal (and making them more efficiently, less expensively, more profitably), we think you'll agree it is metalworking's most powerful selling tool.

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NEW YORK TWIST DRILL *manufactures*

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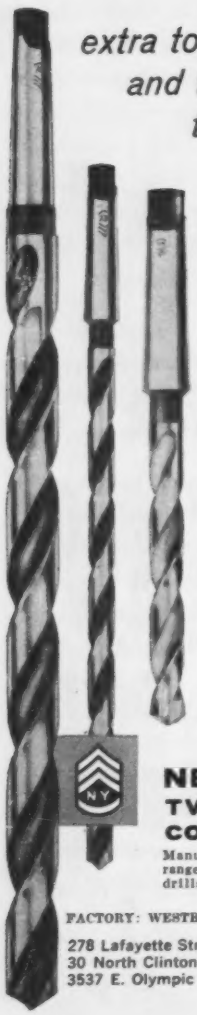
extra tough and true too!



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Free Literature

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MACHINES AND ATTACHMENTS

1 DRILLING, TAPPING, AND BORING MACHINE — *Avey Division, Motch & Merryweather Machinery Co, Cincinnati 1, Ohio.* 10-page bulletin 460-B pictures and describes Turret-Dex Model 250, a 6-spindle turret-type unit available as a standard automatic hydraulic machine or as a numerically controlled machine with a 2 axis work positioning table. Features include preselected speeds, feeds, tapping for any or all spindles, and dwell with positive stop for accurate facing or counterboring operations. Drilling capacity, mild steel, is 1¼ in.; tapping, 1¼; pipe tap, 1 in. Illustrations of tape-controlled rotary index tables and single spindle drills included.

2 AUTOMATIC INTERNAL GRINDER—*Bryant Chucking Grinder Co, Springfield, Vt.* 4-page bulletin gives details on the No. 3216 for grinding either straight or tapered bores in workparts up to 16 in. in diameter. (The unit is also available in a model designed specifically for grinding bearing raceways; this is Model 3216-G). Total swing is 16 in.; grinding stroke (max depth of hole), cam lock spindle 8 in., standard spindle 9 in.; max traverse stroke, 20 in.; total cross-slide movement 3¼ in. workhead is adjustable for grinding included angles up to 60°; rpm of work spindle (infinitely variable) 50 to 750 rpm.

3 TRACER SYSTEMS—*Seneca Falls Machine Co, Electronics Division, Seneca Falls, NY.* 6-page bulletin 1010 covers two simplified, moderate-cost, electromechanical systems using tape, templet, or dial input. Illustrates several applications of single and two-axis systems to new, specially designed equipment, and to retrofitted machines.

4 AUTOMATIC CHAMFER GRINDER — *Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* Illustrated bulletin 483-61 contains information on a new deburring and chamfer grinder for automatic transmission impeller hubs. Model 483 consists of a 48-in.-dia, 6-station index table mounted on a rigid base. As the table indexes, various grinding and wire brushing operations are performed at each station to completely deburr and chamfer a critical torque converter component.

5 ANGULAR MILLING ATTACHMENTS—*Giddings & Lewis Machine Tool Co, Fond du Lac, Wis.* 8-page bulletin A-31 provides data on light, medium, and heavy-duty angular milling, arbor, and spindle-support attachments for use on all table, floor, and planer-type horizontal boring, drilling, and milling machines and planer-type milling machines. Units described include single and two-spindle models; heavy-duty sliding head attachments; cross-rail arbor supports; anti-friction spindle supports, as well as arbor supports, millbore attachments; and special swiveling right-angle attachments for planer-type milling machines.

6 PRESSES—*Federal-Warco Division, McKay Machine Co, Warren, Ohio.* 4-page booklet, "New Tips and Dies, Vol 4 No. 2," contains 28 illustrations with brief descriptive material of some of the many types of Warco presses available.

7 DRILLING HEADS AND FIXTURES—*Hoefer Manufacturing Co, Freeport, Ill.* 60-page catalog 60, in looseleaf form to take supplementary sheets, presents detailed information on line of multiple-spindle drilling and tapping heads, drilling jigs and fixtures, hydraulic feed drilling units, and special unit-type machinery. Engineering drawings and specifications included.

TOOLS AND ACCESSORIES

8 HANDBOOK ON ABRASIVES AND GRINDING WHEELS—*Norton Co, Worcester 6, Mass.* 112-page revised booklet provides basic information on interpretation of grinding wheel specifications, selection of abrasive types, and the care and use of wheels. Reference tables give recommended grinding wheel specifications for many of the common grinding jobs.

9 BALANCING MACHINES—*Gisholt Machine Co, 1245 E Washington Ave, Madison 10, Wis.* 8-page catalog, Form T-1176-B, covers Masterline line of large (Type U) units that provide highly accurate indications of angle and amount of unbalance in one or two planes in rotating parts weighing from 20 lb to 150 tons. Machine features detailed, plus specifications on horizontal and vertical models in several standard sizes.

10 CAR WHEEL BORING TOOLS—*Giddings & Lewis Machine Tool Co, Davis Division, Fond du Lac, Wis.* 8-page catalog D-560 provides information on L-type micrometer adjustable railroad car wheel boring tools. Each tool carries two opposed cutters for roughing and two for finishing, plus a chamfering cutter so that the entire wheel hub boring operation is completed in one pass. The adjustable cutters permit boring a wide range of diameters with a single tool, smallest of which covers a range from 5¼ to 6¾ in., the largest from 9¾ to 12 in.

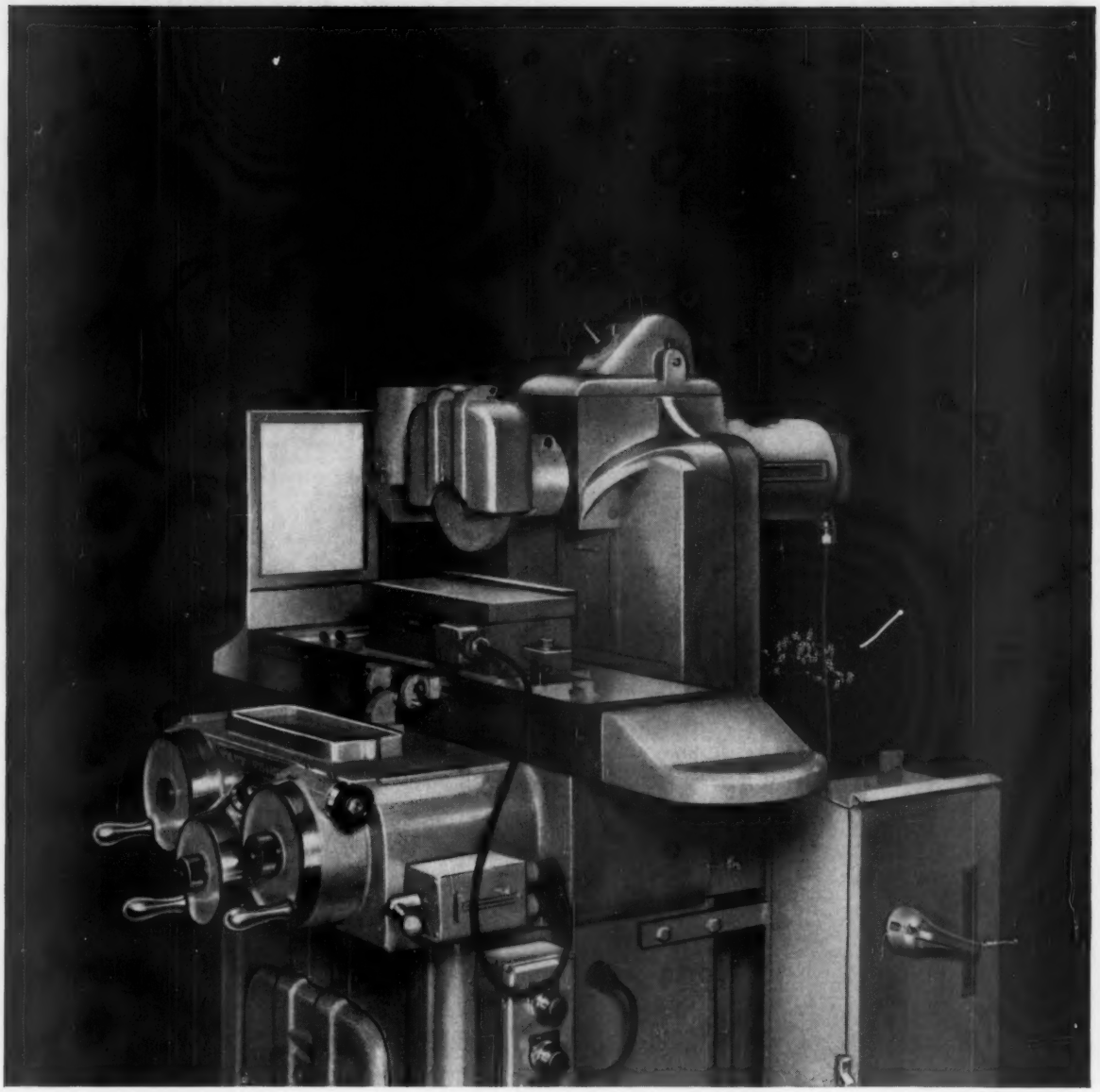
● CARBIDE TURNING TOOLS—*Wesson Corp, 1220 Woodward Heights Blvd, Ferndale, Mich.* 8-page booklet 7-61 discusses 11 major factors affecting tool selection, including scrap costs, part design, tool change time, job specs. Since the company makes on-end, throw-away, and flat tools, the booklet is said to be unbiased, presenting points which greatly aid in tool selection. Request direct on company letterhead.

11 DIE SETS—*Lempco Industrial Inc, Bedford, Ohio.* Catalog illustrates, dimensions, and prices steel, semi-steel and steel, semi-steel plain bearing die sets together with bushings, guide posts, and die supplies.

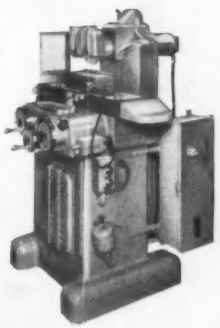
12 SCREWDRIVING TOOLS — *Apex Machine & Tool Co, 1025 S Patterson Blvd, Dayton 2, Ohio.* 16-page illustrated catalog 30-CC, condensed for easy reference, lists power bits, bit holders and insert bits, hand drivers, and special screwdriving tools in standard and magnetic

AM/MM

"This is a triumph of mind over matter: forms, punches, and deburrs in one operation—and it'll cost the company $7,327.69 to replace when you wreck it."



The only Surface Grinder built to meet gagemakers' tolerances

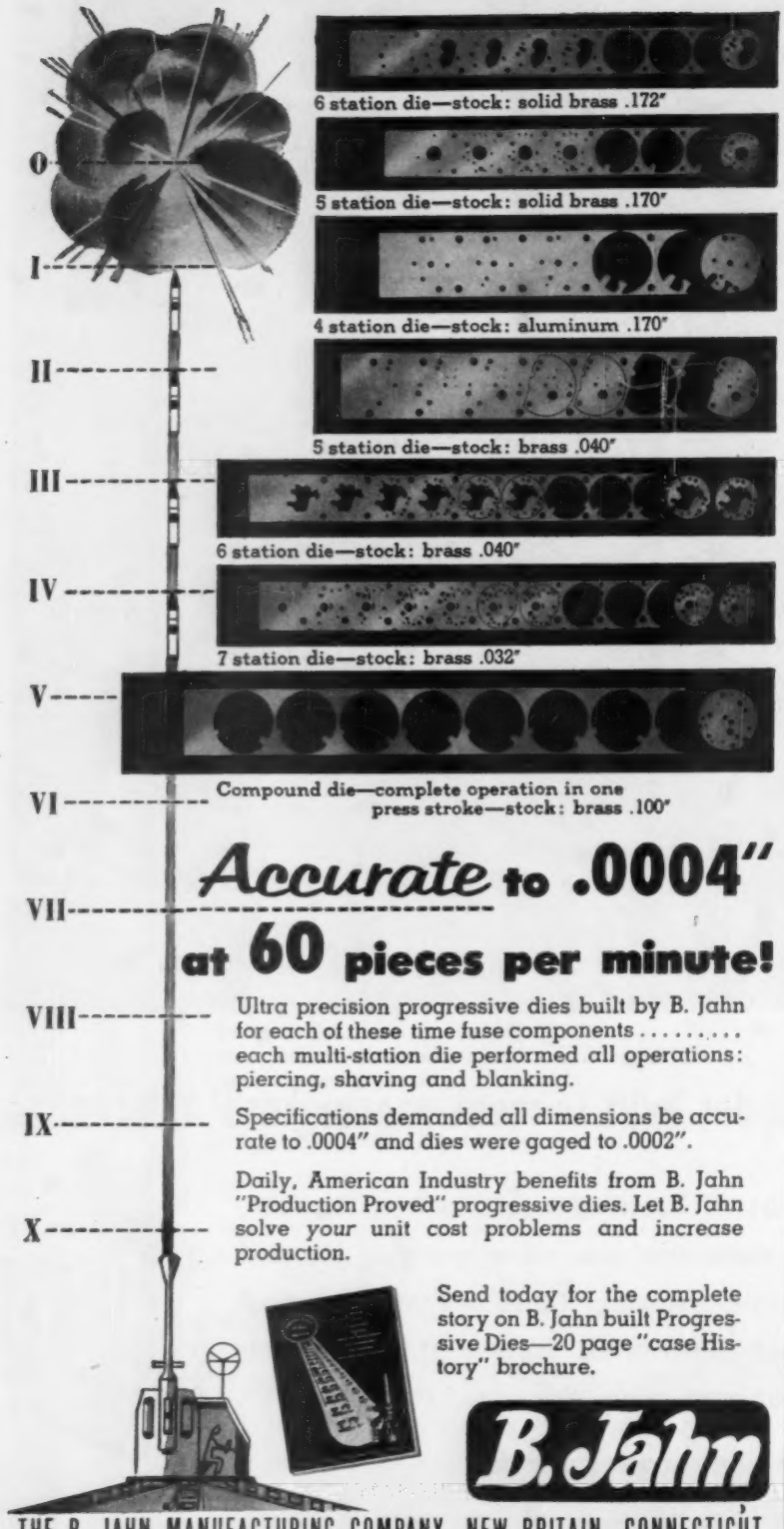


Downfeed accuracy to .000012″. Crossfeed repeatability to .00005″. Tilting wheelhead (0°-30°) eliminates side wheel grinding for slot, undercut, dovetail, sharp corner grinding. .0001″ vernier handwheel graduations. Fine microinch finish with tenth-splitting accuracy maintained on day-in-day-out production. Write for Catalog No. 318.

TAFT-PEIRCE *SURFACE GRINDERS*

13 MECHANIC AVENUE, WOONSOCKET, RHODE ISLAND

TIME FUSE COMPONENTS



Accurate to .0004" at 60 pieces per minute!

Ultra precision progressive dies built by B. Jahn for each of these time fuse components . . . . . each multi-station die performed all operations: piercing, shaving and blanking.

Specifications demanded all dimensions be accurate to .0004" and dies were gaged to .0002".

Daily, American Industry benefits from B. Jahn "Production Proved" progressive dies. Let B. Jahn solve *your* unit cost problems and increase production.

Send today for the complete story on B. Jahn built Progressive Dies—20 page "case History" brochure.

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types. Tools to drive Phillips, Frearson, Reed & Prince, slotted, clutch head, socket head, hex head, spline, slab, Robertson, and Linread screws are shown.

13 CYLINDRICAL PLUG GAGES — *Deltronic Corp, 929 Baker St, Costa Mesa, Calif.* Monthly bulletin, punched for insertion in a binder, consists of four pages containing all information necessary to order the exact gages needed. A listing of over 3000 sizes of individual Class X cylindrical plug gages in stock, shows pricing and ordering information, complete listing of all tenth plug sets in stock, as well as over 3000 individual plug gage sizes in tenths.

14 SAW BLADE SELECTOR CHART— *DoAll Co, Des Plaines, Ill.* 22 x 28-in. wall chart, revised to include the newest products, gives the band machine operator a quick means for proper selection of blade. Includes data for the new Dart, Super Demon, and Tungsten Carbide, as well as the standard carbon alloy and Demon HSS blades. Gives five steps for blade selection, each accompanied by a chart or table to eliminate calculation. Indicates the best blade, recommended speed and feed, preferred coolant, and approximat cutting rate that should be received.

HEAT TREATING AND WELDING

15 HEAT TREATING FURNACE — *Sunbeam Equipment Corp, Meadville, Pa.* 6-page bulletin 17 describes advantages and features of new AF-Casemaster furnace for atmosphere controlled carburizing, carbonitriding, carbon restoration, normalizing, annealing, and hardening in a temperature range from 1400 to 2000 F. Specifications are included for the five standard furnace sizes with heating chamber dimensions ranging from 12 in. wide x 12 in. high x 18 in. long to 30 x 24 x 48 in. Production ranges from 100 to 1000 lb of work per hr.

16 RESISTANCE WELDING CONTROL—*General Electric Co, Schenectady 5, NY.* 8-page bulletin GEA-5945 describes a welding control providing precise timing and transient-free operation for consistent, high-quality welds. Describes application for spot, seam, and benchwelder control and special accessories available.

AM/MM

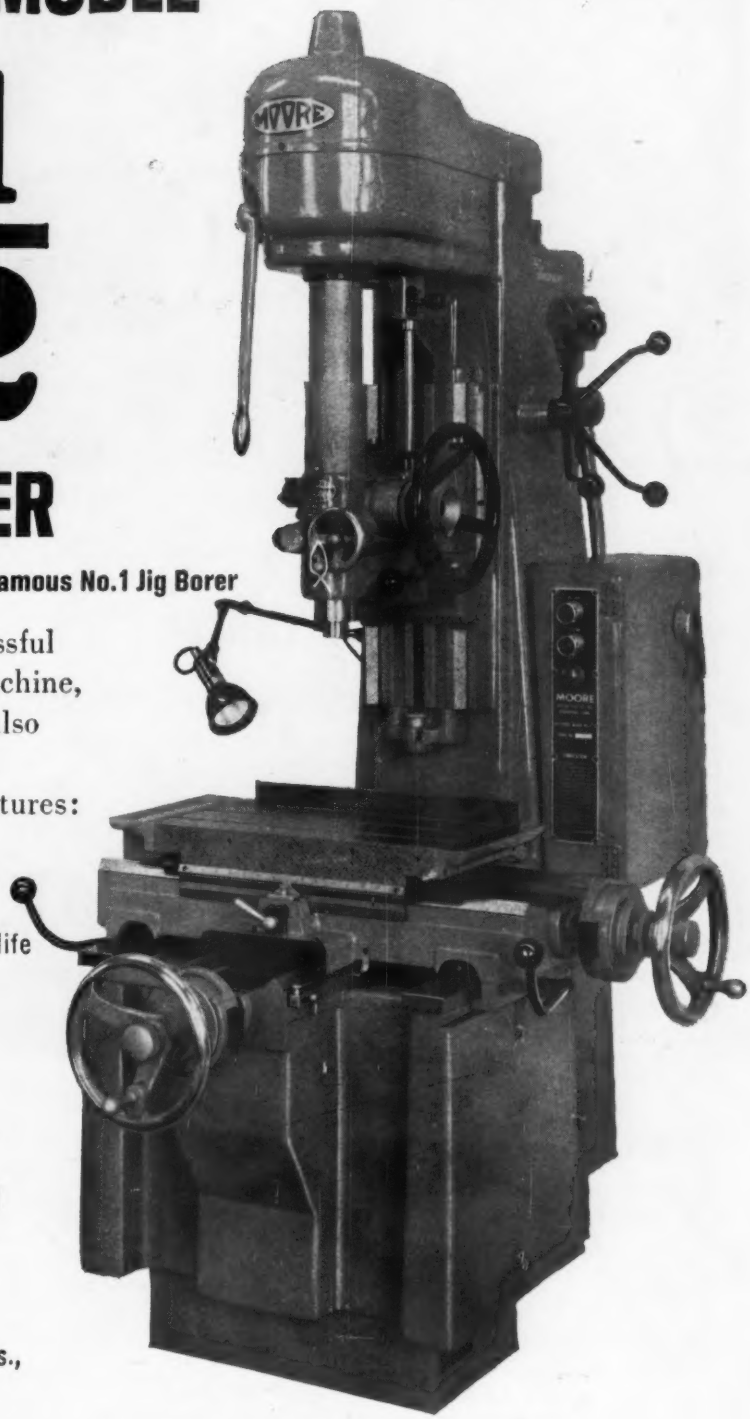
"Say, fellows, just for the hell of it, let's run the tape backward."

THE MOORE MODEL

No. 1½

JIG BORER

—the modern version of the world-famous No.1 Jig Borer



While providing all the successful basic features of the No. 1 machine, the Moore No. 1½ Jig Borer also *cuts its tolerances in half*. . . . you have these 14 "PLUS" features:

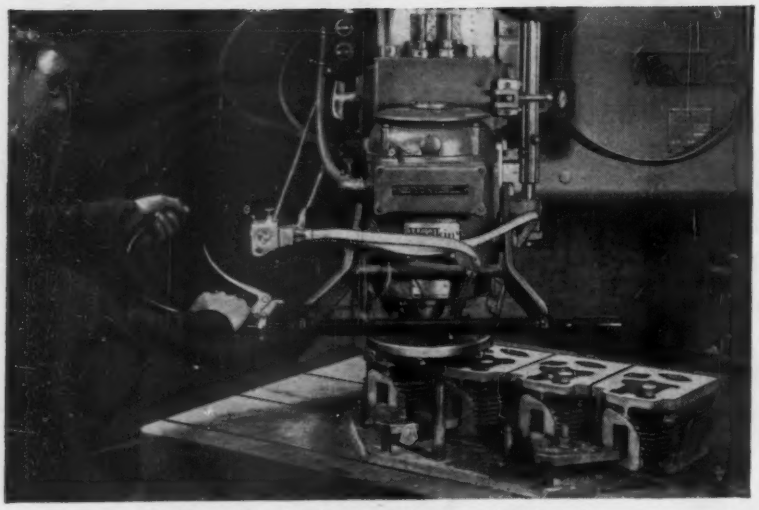
1. Closer tolerances
2. Infinitely variable spindle speed, 120 to 2400 R.P.M.
3. Vee and flat ways, no gibs, longer life
4. No overhang of table or slide
5. Two feeds, .001"—.003"
6. Larger table—10½" x 19½"
7. Single, lever, front & back table clamps, non-influencing
8. More accessible cross clamps, all non-influencing
9. Protected chrome-plated dials and reference scales
10. Micro-setting of vernier dials
11. 1⅜" dia. Nitroloy lead screws
12. Wider column & vee ways
13. More rigidity, more weight (2300 lbs., compared with 1700 for No. 1)
14. J.I.C. conformity

Write today for illustrated folder giving details, including specifications.

MOORE SPECIAL TOOL CO., INC.
738 Union Avenue, Bridgeport 7, Connecticut

ADD MOORE TOOLS TO YOUR TOOLROOM

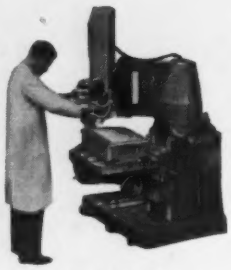
JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES



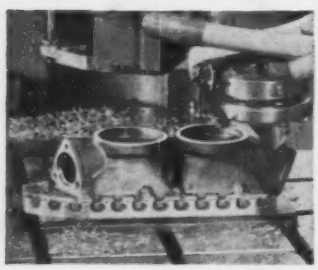
Wadkin Articulated Arm Router, L.C., face milling 4 cylinder heads

Milling ALUMINUM
up to ten times faster than by any other means!

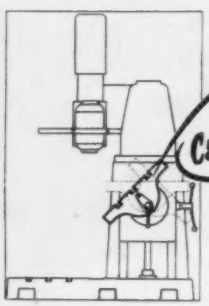
For rapid, precision milling of aluminum components Wadkin Articulated Arm Routers are way ahead. Not only do they boost output and cut production costs, but their price is relatively low as compared with conventional millers. Wadkin machines employ new high speed milling techniques. With cutting speeds up to 18,000 r.p.m., low tooth loading of the cutter, and only light clamping of the component, face-milling is done in a fraction of the time normally taken. On pocketing operations, too, an easily obtained metal removal rate of 20 cubic inches per minute cuts production times down to an absolute minimum.
Three models are available: type L.C. with either 6′ 0″ or 8′ 0″ reach and a smaller type L.C.6.
Write today for Catalog 945 from your nearest Wadkin Agent, listed below.



Wadkin Articulated Arm Router L.C.6



Face-milling a Valve Body component on a Wadkin type L.C.6



This feature not previously associated with routers is fitted to the type L.C.6. It enables the table to be canted to the vertical on both left and right hand sides.

Wadkin HIGH SPEED MACHINE TOOLS

Supreme Machine Tool Corp., 130-140 180th Street, Springfield Gardens, Jamaica 34, N.Y.
Machinery Sales Co., 2838 Leonis Blvd., P.O. Box 58382, Los Angeles (Vernon) 58, CAL.
Wiggleworth Machinery Co., 60 Border Street, P.O. Box 166, East Boston 28, MASS.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

17 WELDING EQUIPMENT CHART—*Raytheon Co, Commercial Apparatus & Systems Division, 225 Crescent St, Waltham 54, Mass.* A chart of "do's and don'ts" on precision welding describes and illustrates 14 major tips for better welding of small electronic components. On the reverse side of the 8½ x 11 card is a checklist for correcting unsatisfactory welds, instructions for solving specific problems, and a description of company's complete line of ac and dc resistance welding equipment.

18 TEMPERATURE-HUMIDITY CHAMBERS—*Electric Hotpack Co, 5035 Cottman Ave, Philadelphia 35, Pa.* 12-page illustrated bulletin describes 14 models of chambers, ovens, and walk-in rooms and seven H-Lo temperature test chambers. Gives details on new Freez-Pak series of mechanical refrigeration (cascade) temperature test chambers. Specifications and prices included for all standard equipment. Section is devoted to special humidity cabinets, humidity ovens, and portable, automatic cycling temperature test chambers.

PLANT SERVICE

● SPECIALTY FINISHES — *Titanine Division, Seagrave Corp, PO Box 405, Union, NJ.* Technical booklet offers a cross index of government specification listings as well as hundreds of suggestions for use of paints, lacquers, and enamels in metal, wood, aircraft, automotive, and architectural finishing. Request direct on company letterhead.

19 LIGHT-DUTY CONVEYOR CHAINS —*Chain Belt Co, PO Box 2202, Milwaukee 1, Wis.* 40-page bulletin 6158P presents application and selection information on Rex chains for handling light-to-moderate loads. Gives specifications on new TableTop and PlateTop chains of Delrin, and Fibre-Lite TableTop sprockets, plus information on steel TableTop and PlateTop chains and Nylon PlateTop. Conveyor designs and selection procedures for these chains together with charts and drawings included

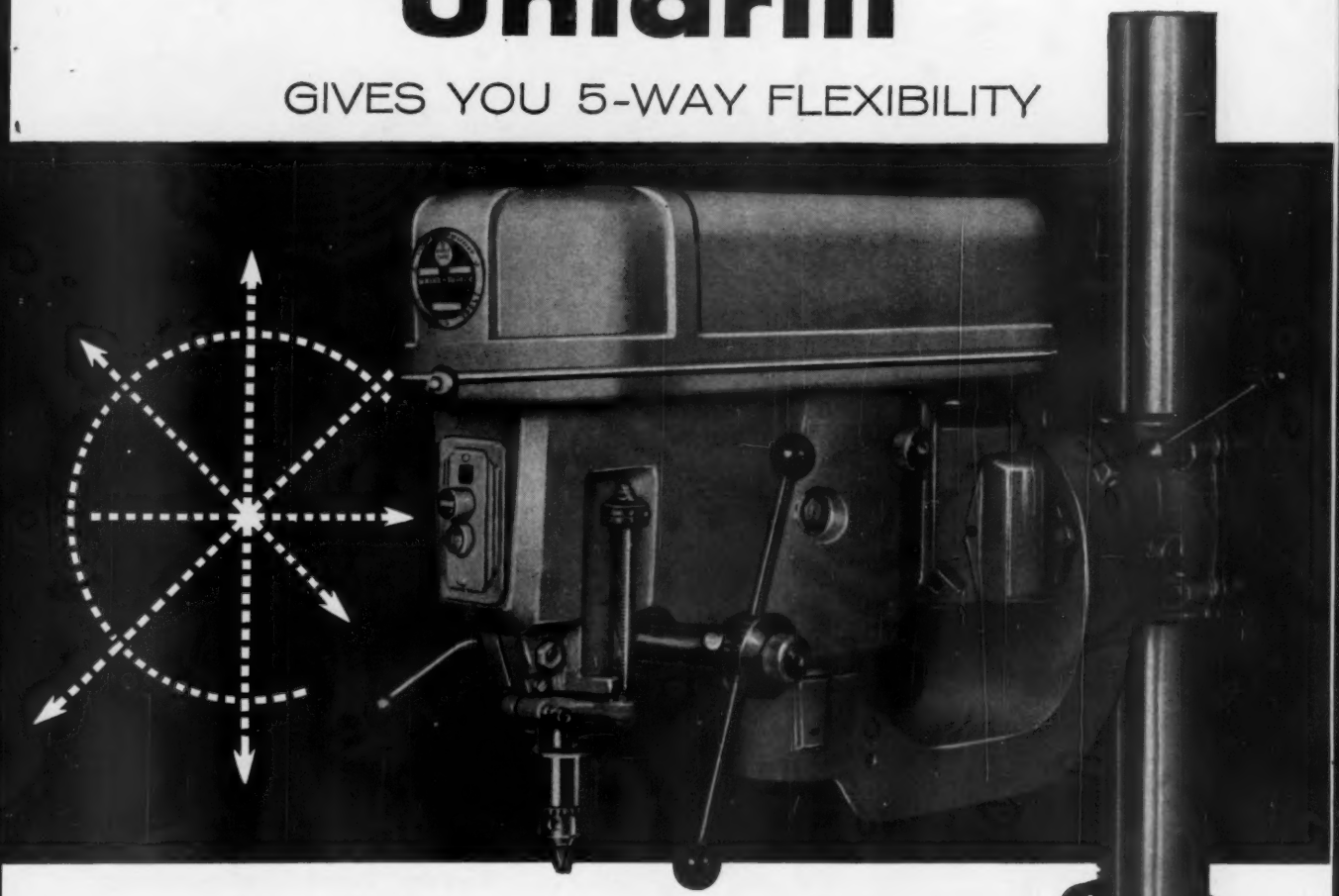
20 FIRE GUARDS—*C M Kemp Manufacturing Co, Glen Burnie, Md.* 12-page bulletin B-10 on guards for flammable and combustible line protection illustrates and describes the Kemp Q A Fire Check

AM/MM

"When I was an apprentice machinist we never thought a thing of driving 12 miles to the shop without power steering an' brakes."

NEW Walker-Turner Unidrill*

GIVES YOU 5-WAY FLEXIBILITY



With the Unidrill you can position the cutting tool to the work in five different ways—move and tilt the drill head to speed the operation, reduce set-up time and eliminate expensive jigs. It's a 2-foot arm radial drill press designed to handle problem drilling jobs—angular drilling, heavy work, bulky pieces requiring extra throat capacity or "reach" of the arm.

You can do reaming, spot facing, counterboring and many other jobs. The Unidrill offers six interchangeable spindles or spindle adapters plus a 12-speed multi-speed attachment that provide even greater versatility.

Ask your Walker-Turner Distributor (listed under MACHINE TOOLS or TOOLS in the Yellow Pages) to show you how the Unidrill can drill to the center of a 48" circle. With one demonstration of this flexibility in action, you'll learn why more people in metalworking call Walker-Turner the *value line.*

FREE BROCHURE shows the full Unidrill line available in floor and bench models with: Utility or Deluxe Head, High or Slo Speed, Key Chuck or Tapered Spindle. Write: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WM-21, 400 N. Lexington Ave., Pittsburgh 8, Pa.

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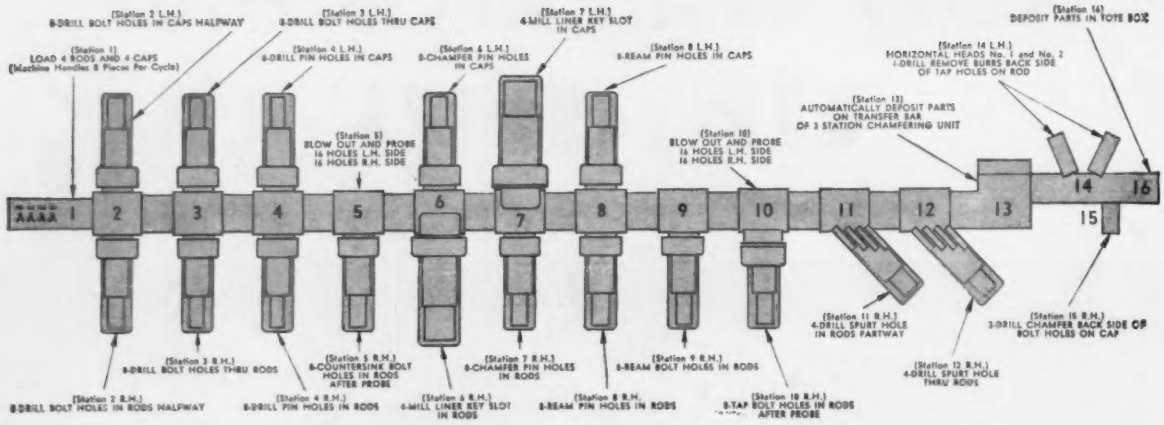
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS
another fine product by
ROCKWELL

CIRCLE 415 READER SERVICE CARD


(Station 1) LOAD 4 RODS AND 4 CAPS (Machine Handles 8 Pieces Per Cycle)
(Station 2 L.H.) 8-DRILL BOLT HOLES IN CAPS HALFWAY
(Station 3 L.H.) 8-DRILL BOLT HOLES THRU CAPS
(Station 4 L.H.) 8-DRILL PIN HOLES IN CAPS
(Station 5) BLOW OUT AND PROBE 16 HOLES L.H. SIDE 16 HOLES R.H. SIDE
(Station 6 L.H.) 8-CHAMFER PIN HOLES IN CAPS
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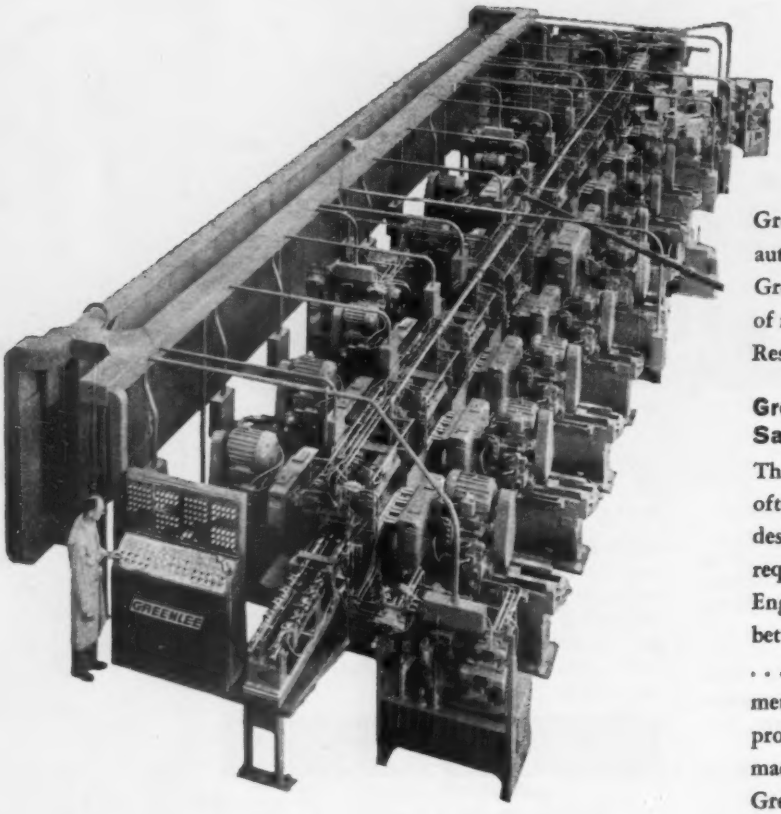
(Station 13) AUTOMATICALLY DEPOSIT PARTS ON TRANSFER BAR OF 3 STATION CHAMFERING UNIT
(Station 14 L.H.) HORIZONTAL HEADS No. 1 and No. 2 1-DRILL REMOVE BURRS BACK SIDE OF TAP HOLES ON ROD
(Station 16) DEPOSIT PARTS IN TOTE BOX
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
(Station 2 R.H.) 8-DRILL BOLT HOLES IN RODS HALFWAY
(Station 3 R.H.) 8-DRILL BOLT HOLES THRU RODS
(Station 4 R.H.) 8-DRILL PIN HOLES IN RODS
(Station 5 R.H.) 8-COUNTERSINK BOLT HOLES IN RODS AFTER PROBE
(Station 6 R.H.) 4-MILL LINER KEY SLOT IN RODS
(Station 7 R.H.) 8-CHAMFER PIN HOLES IN RODS
(Station 8 R.H.) 8-REAM PIN HOLES IN RODS
(Station 9 R.H.) 8-REAM BOLT HOLES IN RODS
(Station 10 R.H.) 8-TAP BOLT HOLES IN RODS AFTER PROBE
(Station 11 R.H.) 4-DRILL SPURT HOLE IN RODS PARTWAY
(Station 12 R.H.) 4-DRILL SPURT HOLE THRU RODS
(Station 15 R.H.) 3-DRILL CHAMFER BACK SIDE OF BOLT HOLES ON CAP

British Automobile Manufacturer Uses Greenlee Transfer Machines to Produce Connecting Rods



Greenlee was selected by a large automobile manufacturer in Great Britain to help solve the problem of machining connecting rods and caps. Results: 320 connecting rods every hour.

Greenlee "Cooperative Engineering" Saves You Time and Money

The need for increased efficiency often requires new machines . . . designed and built to meet your requirements. "Cooperative Engineering" is an exchange of ideas between you and Greenlee engineers . . . ideas that result in the best methods and machines to produce your products. This 16 station transfer machine is an excellent example of Greenlee "Cooperative Engineering". Investigate "Cooperative Engineering"! It will mean increased profits for you.

PRODUCTION MACHINERY

GREENLEE BROS. & CO.

SINCE 1863 — 2002 Mason Avenue, ROCKFORD, ILL., U.S.A.

TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS
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for fuel-fired combustion systems which autohatically shuts off the flow of combustible mixtures when flashback occurs in the line. Other fire guards are pictured and discussed.

● AIR-CONDITIONING—*Acme Industries Inc, 600 N Mechanic St, Jackson, Mich.* 32-page brochure comprises a collection of case history reports on cooling people, places, products, processes, and plants. Request direct in company letterhead.

21 STORAGE PLANNING GUIDE — *Frick-Gallagher Manufacturing Co, Wellston, Ohio.* 48-page catalog is a guide for selecting storage equipment for everything from the smallest parts to palletized loads; also provides information on storage planning.

22 4-VANE AIR PUMPS — *Leiman Bros Inc, 102 Christie St, Newark 5, NJ.* 6-page bulletin 9161 covers three new units providing a range of vacuum to 26 in. hg, pressure to 13 psig, and volumes from 12 to 54 cfm. Includes performance curves based on horsepower and cfm, plus dimensional data and prices.

23 RUST AND SCALE REMOVER — *Diversey Corp, 212 W Monroe St, Chicago 6, Ill.* Data sheet provides information in Everite, a fast-acting agent for removing rust from finely polished parts without etching or acting upon the metal surface, and from metal surfaces being prepared for repainting. It reportedly will not change dimensions of forgings and castings. It may also be used to remove rust, hard-water scale, and other accumulations from water-cooled equipment, engine radiators, water jackets, heat exchangers, and piping.

PARTS AND MATERIALS

24 CYLINDERS—*Tomkins-Johnson Co, 2425 W Michigan Ave, Jackson, Mich.* 48-page bulletin SQ-61 is a completely revised and expanded catalog for the Squair Head cylinder line. Contains technical dimensions and engineering data on the entire line for 1½ through 14-in. bore sizes.

"It's a shame somebody doesn't invent a fool proof hammer!"

ONE...
just set the part on the anvil (no masters or set gages needed)

TWO...
turn the knob to lower spindle (stops automatically on contact)

THREE...
read the measurement directly from the scale (and save up to 85% in gaging time!)

MEASURE TO .0001"!

...that's how quick and easy it is with the Bausch & Lomb DR-25B Optical Gage!

Takes just seconds to get direct readings to .0001" . . . depth, thickness, height, diameter, taper. You read in "tenths" from 0" to 3" on a bright, magnified scale . . . with such extreme accuracy (0.000025") that masters or set gages are unnecessary. Specially calibrated to normal shop temperatures with easy conversion charts for any temperature fluctuation. Here's today's fastest, easiest way to get highest accuracy readings . . . with job-proved savings of as much as 85% in gaging time . . . for only $875!
See it, compare it, in a free on-the-job demonstration.

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☐ Please send Catalog D-285.

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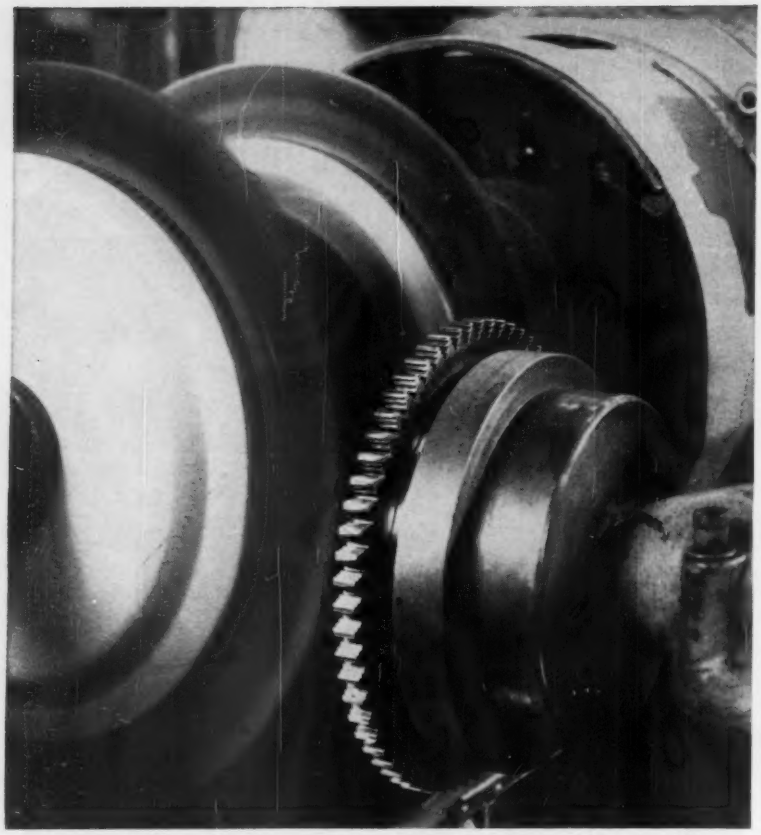


GAS TURBINE DISC DOVETAILS are deburred rapidly, automatically on Osborn 3A Finishing Machine using Osborn 14" Tufmatic® power brushes. Cycle time—floor to floor: 5 minutes . . . *9 times faster than former method.*

COST CUT 90% deburring with OSBORN power brushing

Before: deburring the 64 dovetails milled on this gas turbine disc was a problem for this major producer of jet engine components. Off-hand filing was slow and costly . . . took 45 minutes per part . . . cost about $5.00 per disc.

Now: an Osborn 3A Finishing Machine—equipped with two Osborn Tufmatic® power brushes—deburrs the part automatically in just 5 minutes . . . *9 times faster.* Finishing cost is down to 50¢ per part . . . *a 90% cost reduction.* And production quality is consistently higher, more uniform.

Osborn power brushes and advanced brushing methods can help *you* same time and money on metal finishing operations of every description —deburring, cleaning, polishing, precision blending. An **O**sborn **B**rushing **A**nalysis—made at no obligation in your plant now—is the first step to savings like these. Write or call *The Osborn Manufacturing Company, Dept. C-119, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

OSBORN

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery

Free Literature

To order any of these bulletins, circle correspond.ng number inside back cover.

25 SLIP RING ASSEMBLIES — *Superior Carbon Products Inc, 9115 George Ave, Cleveland 5, Ohio.* 12-page catalog SR-1 covers scope and application: standard slip ring assemblies; cartridge type brush holders; custom design of slip rings and brush holder assemblies; standard silver contacts; rotary switches. Slip ring units or assemblies can be supplied in a multitude of sizes, shapes, and styles.

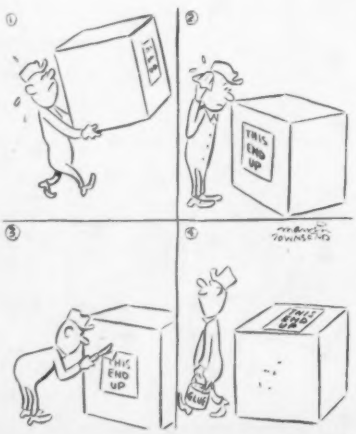
26 OIL-HARDENING TOOL STEEL —*Dodge Steel Co, 6501 State Rd, Philadelphia 35, Pa.* Technical data sheet describes new grade DTS-60 for general purpose application. Includes information on hardening, annealing, tempering, hardness, suggested applications.

28 COLD EXTRUSION—*Republic Steel Corp, 1441 Republic Bldg, Cleveland 1, Ohio.* 8-page folder, Adv 1290, discusses some of the important advantages of the process. Photos of typical cold extruded parts are included. Type of steel required, and the importance of selecting the right steel are covered.

29 ELECTRO-MECHANICAL COMPONENTS—*Tech-Ohm Electronics Inc, Siamco Division, 36-11 33rd St, Long Island City 6, NY.* 140-page catalog 100 features such items as precision gears, magnetic clutches and brakes, differentials, couplings, gear heads, limit stops, bearings, electronic hardware and other items which have application in the electro-mechanical field.

30 TUBES AND BARS — *Peterson Steels Inc, Union, NJ.* 14-page catalog and stock list describes line of tubes, bars, strip steel, and forgings. Heat treatment data is included along with charts of sizes, analysis, weights, finishes, and tolerances.

31 INVESTMENT CASTINGS — *Hitchiner Manufacturing Co, Milford, NH.* Pocket folder, "Quick Facts," lists major advantages of the lost wax process for producing machine parts from almost any desired alloy or metal. Tables are included for determining general tolerances, flatness, straightness, concentricity, roundness, accuracy of angles, hole positioning, keys and keyways, parallel sections, wall thicknesses, and surface finish values. Sequence of steps normally used in producing an investment casting is illustrated and described.



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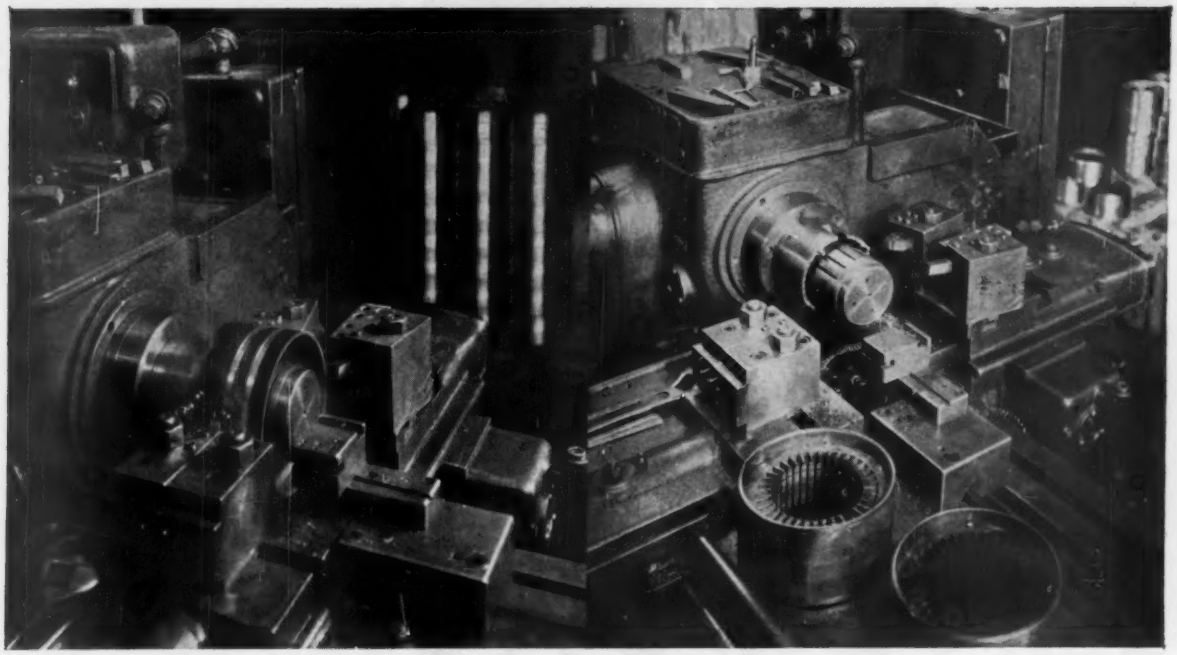
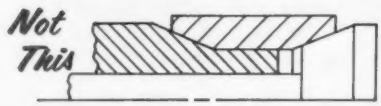
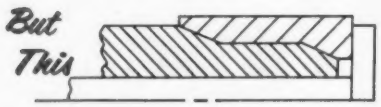


Chuck Internally within 0.0005-in. TIR... and get faster loading, higher speeds and heavier feeds!

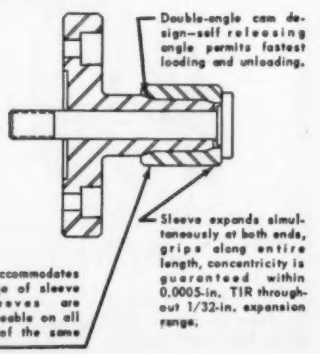
ERICKSON Expanding Mandrels



Concentricity poor—cam surfaces on 3 parts; tendency to rock.
Sleeve expansion not uniform.
Half of work and cutting load carried by drawbar.



Concentricity assured—cam surfaces on 2 mating parts.
Sleeve expansion perfectly uniform.
All of work and cutting load carried by mandrel shank.


Double-angle cam design—self releasing angle permits fastest loading and unloading.
Sleeve expands simultaneously at both ends, grips along entire length, concentricity is guaranteed within 0.0005-in. TIR throughout 1/32-in. expansion range.
Mandrel accommodates wide range of sleeve sizes—sleeves are interchangeable on all mandrels of the same series.

You can take higher cutting speeds and heavier feeds when you don't have to worry about work slipping on the mandrel. With an Erickson Expanding Mandrel, you get unmatched holding power plus accuracy guaranteed within 0.0005-in. TIR—a combination that brings you lowest possible production costs. Loading and unloading are faster, too—because Erickson expanding mandrels collapse instantly for quick release—provide a full 1/32-in. clearance for loading parts. No need to sacrifice loading speed for close fit between mandrel and work.

You save on downtime with an Erickson expanding mandrel, because replacement sleeves come right off the shelf. A handful of replacement sleeves lets you handle a wide size range—and retain top accuracy year after year.

The Erickson expanding mandrel has much greater holding power than a solid mandrel or a single-purpose split arbor because it expands *uniformly*—grips over the entire sleeve length, not just in a narrow ring. To achieve this powerful holding action, Erickson uses an exclusive double-angle mandrel design. The hardened, precision-ground sleeve is forced back over two camming surfaces which expand both ends of the sleeve simultaneously.

Standard Erickson expanding mandrels cover a wide size range—from ½ through 18-in. in diameter. Many different models are available, including adaptations for small holes.

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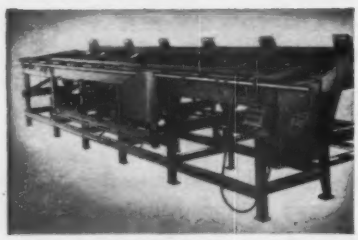
4500 TO 6500 PIECES PER HOUR

Pines-Grieder Cut-Off Machines cut round tubing up to 4" diameter, with wall thickness up to .250", and will handle rectangular or other tube shapes. Any length is cleanly cut with extreme accuracy . . . dual shear cut eliminates tube-end distortion. Cuts steel, stainless, and non-ferrous metals in 1/3 second cycle time. With feed speeds to 600 ft. per minute, length of piece determines production rate. Tooling quickly and easily changed for various tube sizes. *REQUEST CATALOG 441*



AUTOMATIC LOADER AND FEEDER for Pines-Grieder cut-off equipment. Frees operator by automatically feeding up to 15,000 lbs. of stock in lengths to 22' through the machine. These units are also suitable for feeding other types of equipment.
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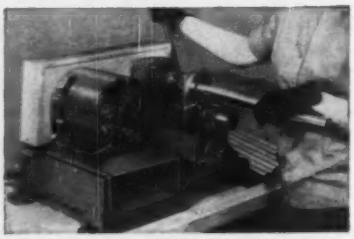

PINES END FINISHING MACHINES simultaneously deburr, chamfer, face, tube, pipe or rod. Handle stock to 5" diameter with high production rates, long life accuracy. Quick, simple tooling and set up. Five models available, manual or automatic, to handle single or double end operations.
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Specialists in Tube Fabricating Machinery
670 WALNUT ST. • AURORA, ILLINOIS

★ NEWS NOTE: GRIEDER INDUSTRIES, INC. HAS BEEN MERGED INTO PINES, PIONEER BUILDERS OF QUALITY BENDING EQUIPMENT.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

32 VINYL FINISHES—*Metal & Thermit Corp, Coatings Sales Office, Carteret, NJ.* Brochure describes Unichrome B-66 multicolor, spray-on finishes. Designed primarily for application on metals such as aluminum, steel, or magnesium, it can also be used for coating molded fiber glass, transite, and similar surfaces. Features include high resistance to chemicals and staining and excellent wear and abrasion resistance.

33 SPEED REDUCERS—*D O James Gear Manufacturing Co, 1140 W Monroe St, Chicago 7, Ill.* 36-page catalog 43C includes handbook information to help select right-angle spiral bevel-helical gear speed reducers. Complete specifications charts, tables, and dimensional drawings are supplemented by formulas for selecting horizontal and vertical type units; a guide to load characteristics on many applications; and step-by-step examples of reducer selection. Rating charts are provided for 42 standard sizes of double and triple-reduction units capacities of which range from 0.14 to 637 hp; 6:1 to 358:1 ratios.

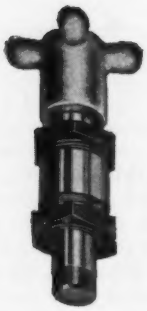
34 COPPER-ZIRCONIUM ALLOY — *American Metal Climax Inc, 1270 Avenue of the Americas, New York 20, NY.* 38-page technical handbook contains a comprehensive survey of the various properties of Amzirc, specially developed to combine retention of high strength at elevated temperatures with high conductivity. Charts, graphs, tables, photomicrographs, and pictures help to describe the nature of the material, its fabrication, room temperature properties, and elevated temp properties. Case histories included.

● AIR CYLINDERS—*Rivett Lathe & Grinder Inc, Brighton 35, Boston, Mass.* 16-page manual 10 illustrates and describes operation and application of Squaremaster units. Includes engineering drawings and specifications of the eight mounting styles available. Request direct on company letterhead.

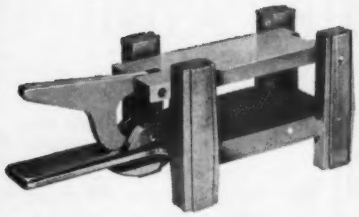
25 REINFORCED PLASTIC PARTS—*Bischoff Chemical Corp, 220 Miller Rd, Hicksville, NY.* 4-page bulletin shows design possibilities for molding parts of reinforced plastics with electric heaters integral. Describes various types of laminations, typical molded parts, and gives performance curves for different laminations and electrical inputs. ●

AM/MM

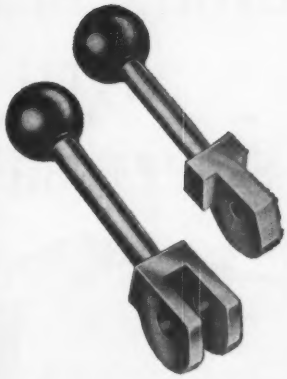
"I knew it, we've been going in circles—we're lost, aren't we?"



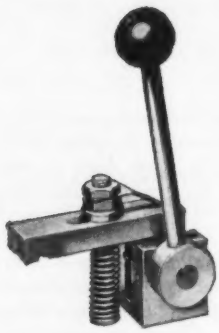
LONG TRAVEL CLAMPS



LEAF JIGS



SINGLE AND DOUBLE CAMS



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WESPO can show you 1170 ways to cut Jig and Fixture costs!

Wespo catalog No. 12 lists more than 1170 *standard* jig and fixture components—everything from simple c-washers and straps... to automatic cam clamps... to precision leaf jigs. Since components are usually a significant part of the total cost of a jig or fixture, use of standard components can result in appreciable savings, as well as hurry completion of the jig or fixture.

So, before you take the time and trouble to machine costly, custom fixture hardware, look in your Wespo catalog, or check with your Wespo distributor. Chances are you'll find just the component you need as a Wespo *standard.*

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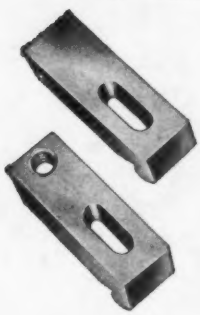
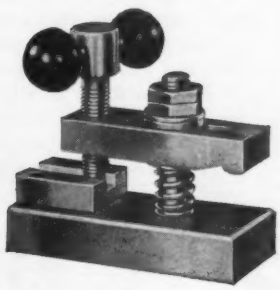
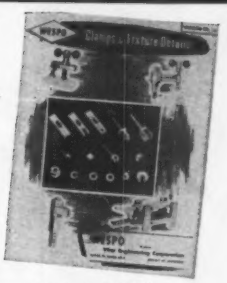


STRAPS

HAND KNOBS



CLAMPS



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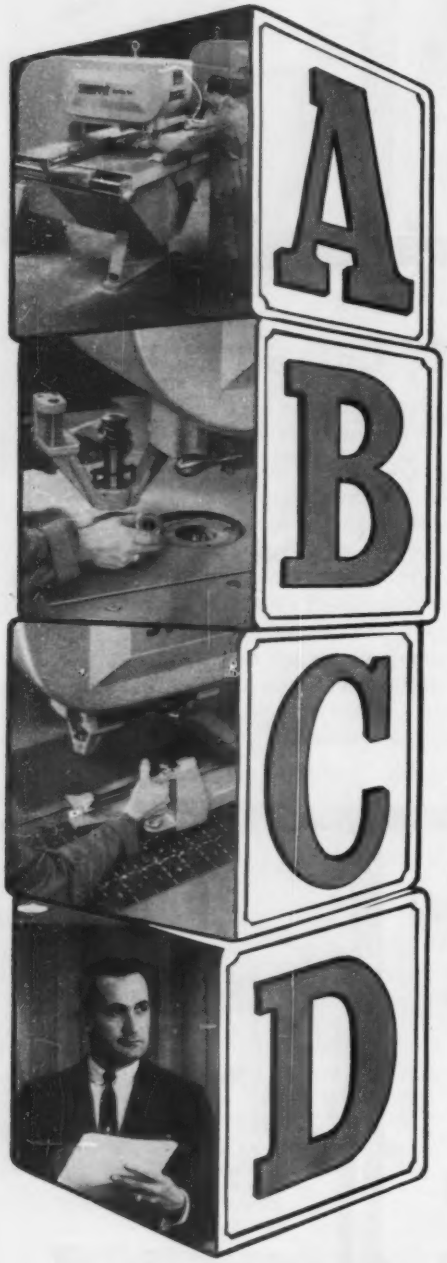

A multi-purpose, single station sheet metalworking machine, the STRIPPIT Super 30 Fabricator punches round and shaped holes in workpieces up to 60" wide...any length. Punches close-centered hole clusters in material to ¼" thick . . . nibbles straight or contour lines in ⅛" material ...notches 90° corners, radii and special edge notches in material up to ⅛" thick.

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Convert STRIPPIT Super 30 Fabricator to an efficient medium run production unit simply by adding our Duplicator attachment. Another useful accessory is our Dupl-O-Scope, a high quality optical instrument designed specifically for translating blueprints, drawings, etc. into accurate templates or "one-of-a-kind" finished pieces.

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NEW FILMS...

SOLID CARBIDE TOOLS AND BURRS. *Produced by Atrax Co, Newington 11, Conn. 16 mm, sound, color. Running time 22 min. No charge.*

Planned specifically for showing to carbide societies, cutting tool groups, and industrial meetings, this film may be accompanied by an Atrax service engineer to conduct a question and answer period after the meeting. It deals with the manufacture and use of solid carbide tools and burrs, from the carbide blank to the finished tools, and on to such unusual applications as end milling high-tensile stainless turbine buckets. Close-up shots show production techniques on modern, exclusive, automatic grinding equipment, and point out the close control of tolerance to insure complete uniformity.—HEL

•

CLEANING PRINTED CIRCUIT BOARDS. *Produced by National Ultrasonic Corp, 95 Park Ave, Nutley, NJ. Slide film, sound, color. Running time 30 min. No charge.*

The problems involved in cleaning printed circuit boards are discussed, and solutions are offered in the form of ultrasonic cleaning with Freon solvents. Slides show the variables in the flux removing system, characteristics and categories of solvents, and explain how the system works. Also shown are the methods used to determine whether the boards are really clean, and cost data are presented. At the end of the program, the process is demonstrated with circuit boards manufactured by the audience.—HEL •

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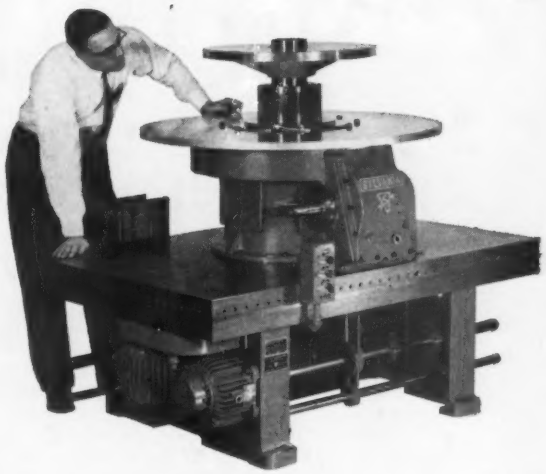

The high cost of automation may not be as high as you think.

Not if you get your automation program's basic building block—an automatic transfer machine—from Sylvania.

For Sylvania automatic transfer machines cost less than machines which can meet their productivity and precision standards. And they're more precise and more productive than other machines in their price class.

FOR EXAMPLE

Our Heavy Duty Rotary Indexing Chassis is a case in point.

It's the *only* rotary transfer machine on the market with lever pivot shafts built in.

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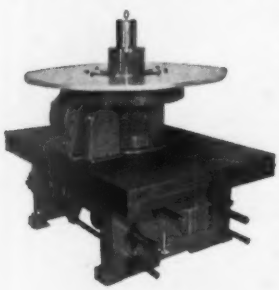
THINKING ABOUT AUTOMATING?

If you are, you probably know that every automation program must start with a transfer machine. If it's a good one, you'll be off to a good start. If it's not, you're defeating your purpose because your program will probably never be satisfactory.

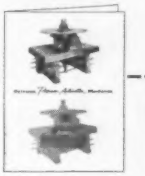


Sylvania makes several different kinds of transfer machines. By changing the tooling, they can be adapted to any conceivable production operation. You can change products without changing transfer machines.

We'll provide you with free consultation to help get your automation program started—even recommend experienced designers and manufacturers of tooling if you don't have the facilities to do the job.

Since a good transfer machine will last 30 years or more, it pays to get the best. We think ours are, because we've never been able to find one that will meet our accuracy standards for the manufacture of lamps, tubes and fine electronics equipment. That's why we build our own.

We'll be glad to send one of our automation sales engineers to consult with you on your automation program and needs. If you'd like more details on the transfer machines we build, send for our free brochure. Naturally, there's no obligation.



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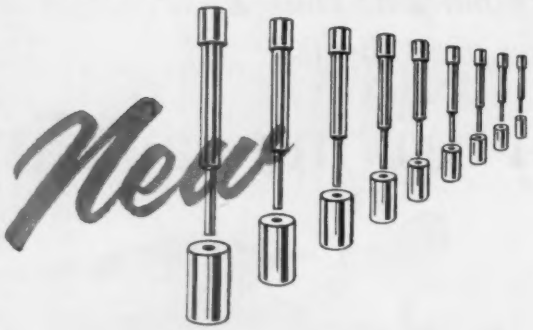

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Punches are stocked in standard point sizes from .060" to .374" together with corresponding die bushings . . . all made to the high quality and precision standards established by Oberg and recognized everywhere.

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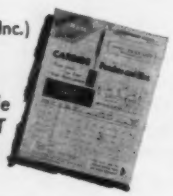

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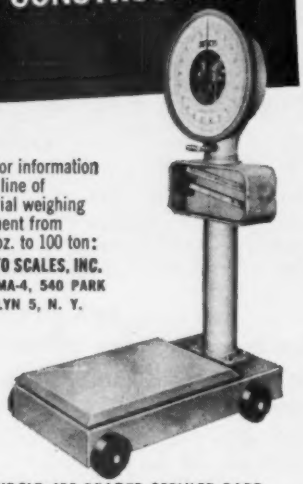

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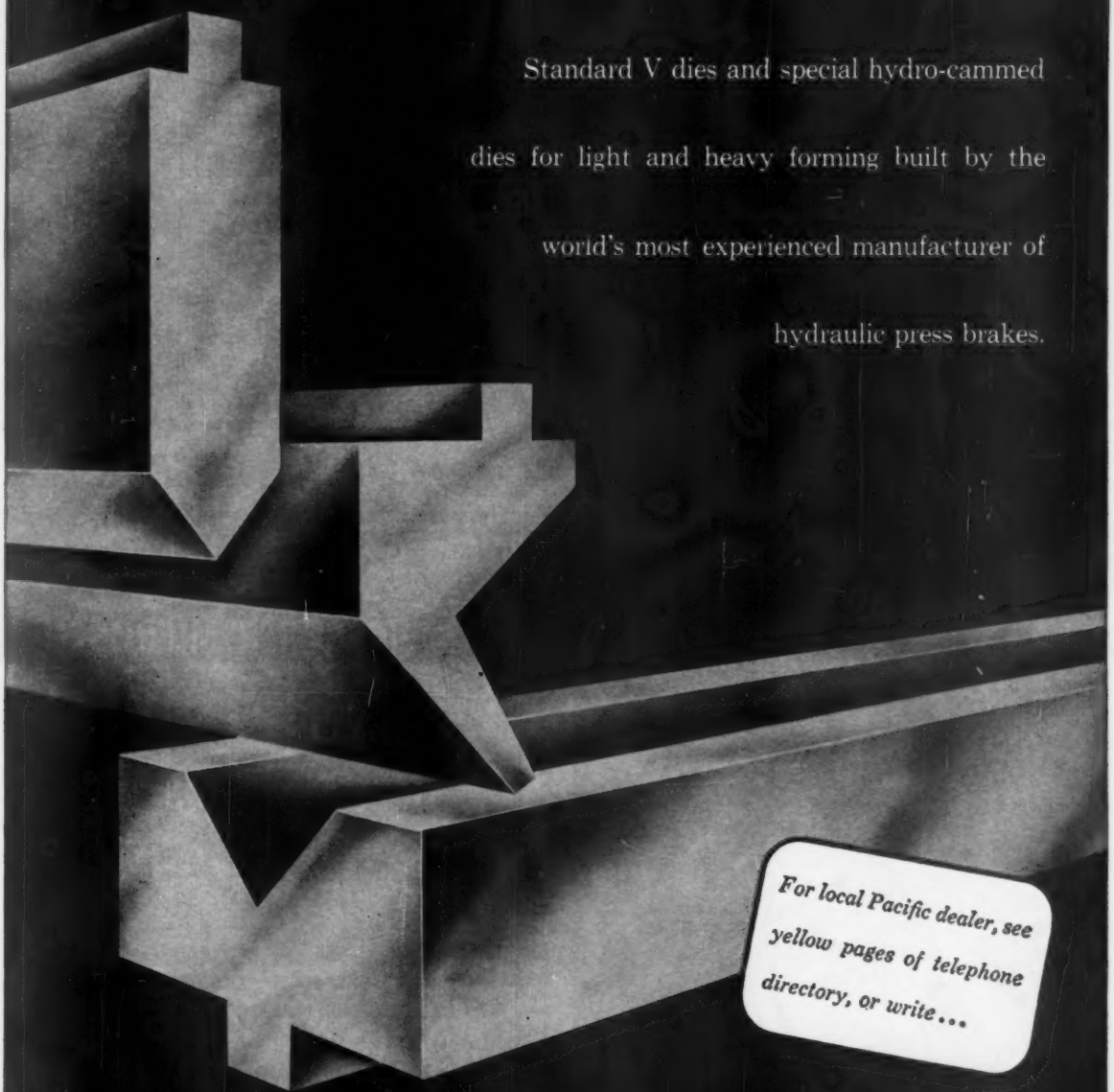

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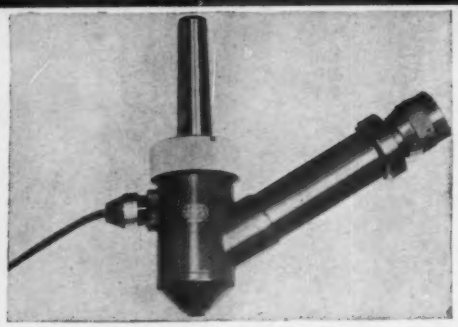

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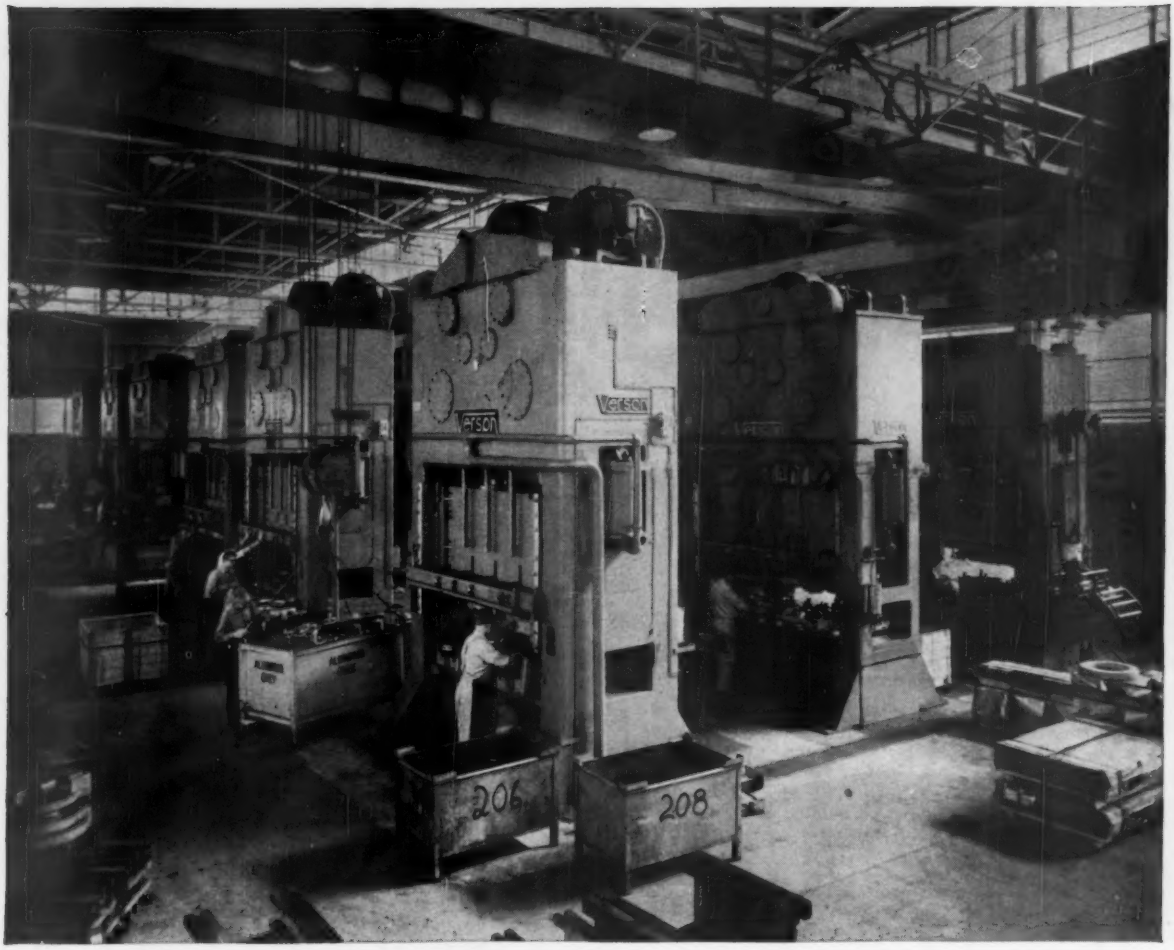

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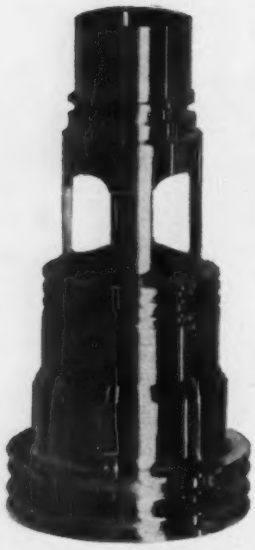

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00	.125	1¼	.040	.008	.020
0	.156	1¼	.048	.010	.030
1	.187	1¼	.057	.012	.035
2	.250	1½	.069	.014	.044
3	.250	1½	.081	.015	.050
4	.312	1½	.089	.016	.055
5	.312	1½	.099	.017	.065
6	.312	1½	.107	.018	.065
8	.375	1½	.132	.019	.090
10	.375	1½	.151	.020	.095

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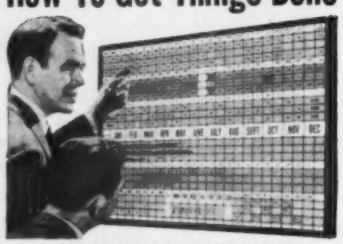

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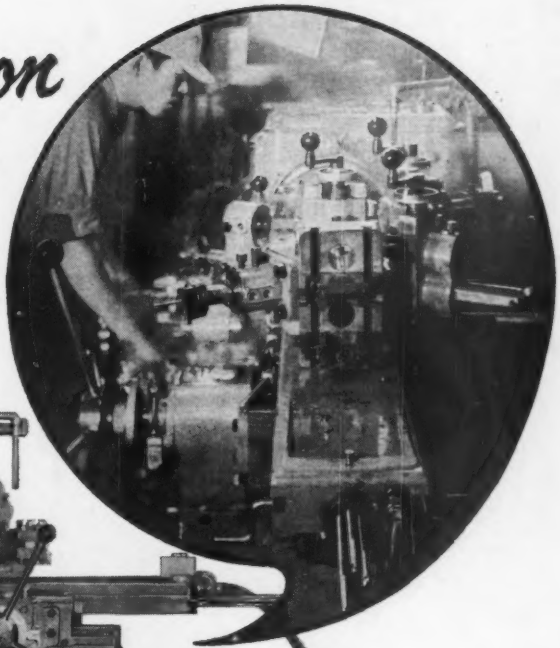

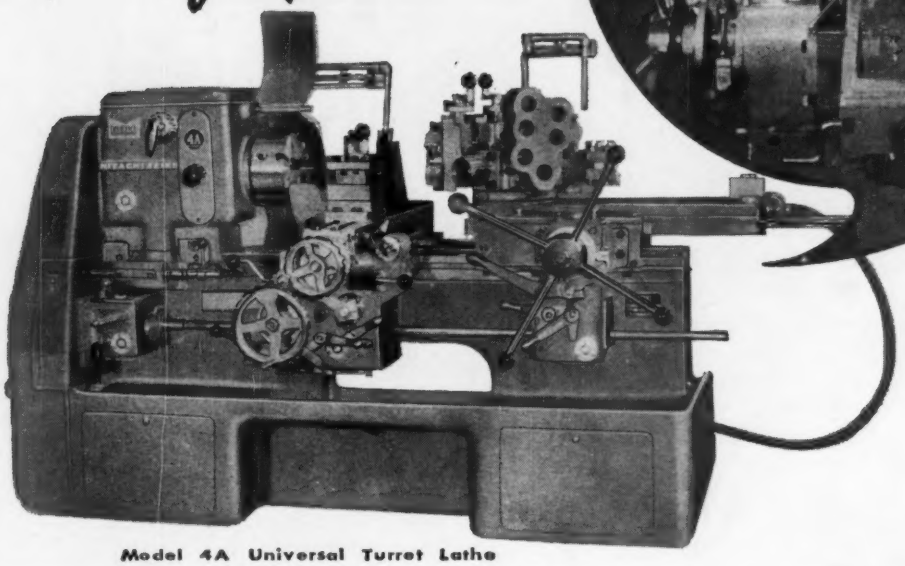

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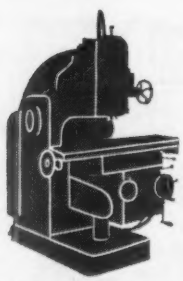
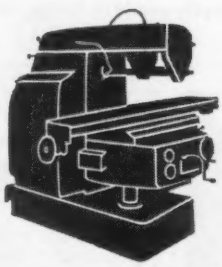
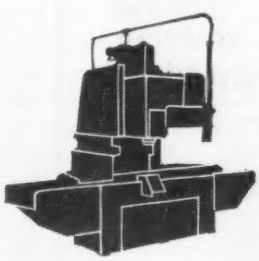


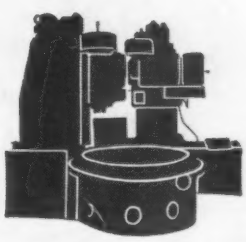
Medium Duty Milling Machine (Vertical Type)



Heavy Duty Milling Machine (Plain Type)



Production Milling Machine (Vertical Type)



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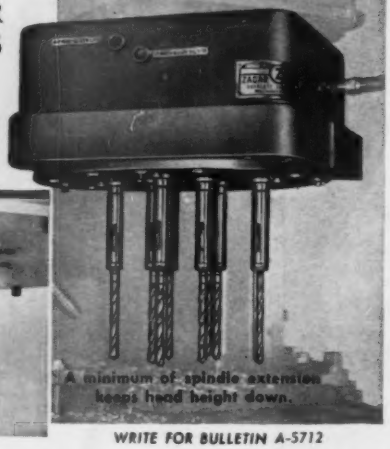

A minimum of spindle extension keeps head height down.

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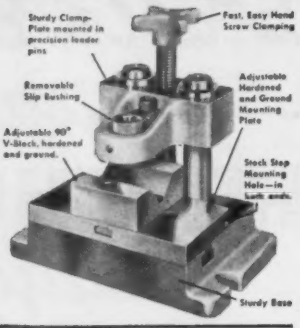
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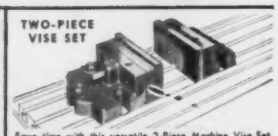

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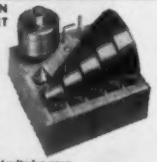

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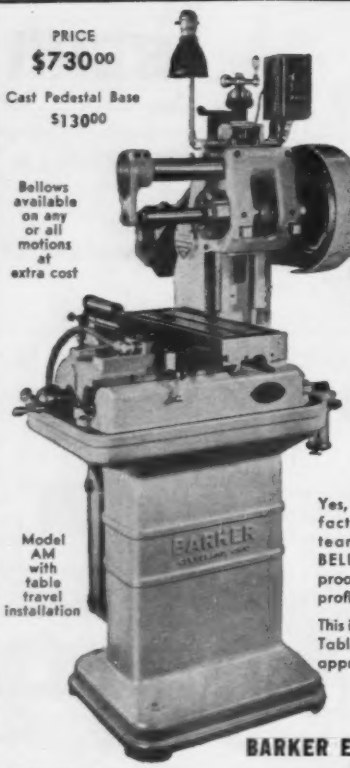

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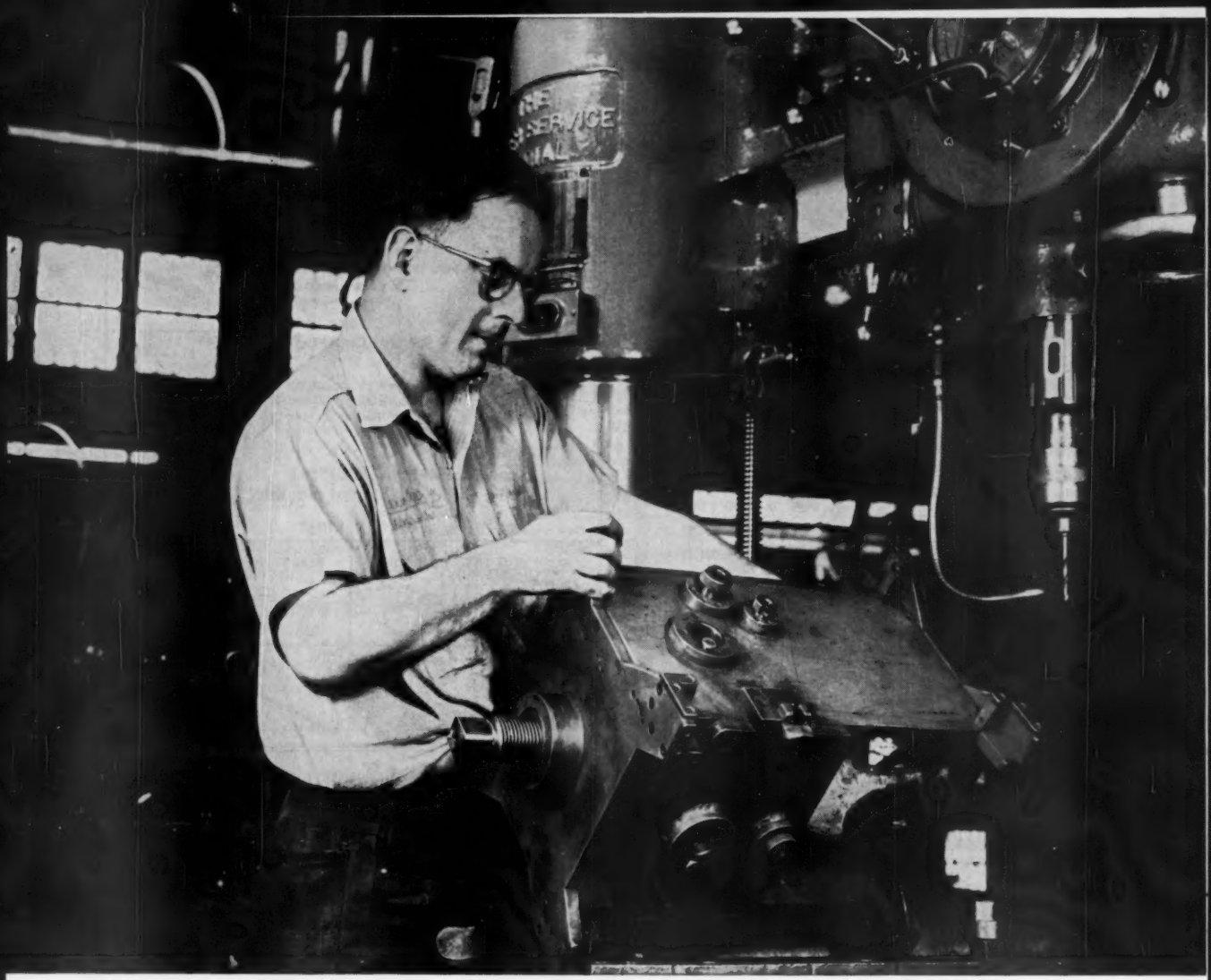

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37. Milling Machines
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69. Books

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*Type A Barber Coleman Hobbers (1 long bed)
**65A3 Fellows Shaper w/access
*Type 6 Fellows #6I Shaper 35" OD Cap 1950

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**Blake Flue Grinder to ⅝" Cap
*4 x 12 Landis Ext. w/Plunge (2)
*6 x 18 Landis Ext. w/Plunge #24473
*12 x 36 Cine. Univ. w/Int. Spdl. RBG
**10x24 No. 4BGI Van Norman 15° Head '58
**30x48 Landis CHW Univ Like New 1952
*#2 Cine. Centerless, Profile Dresser RBG
*16 x 36 Landis Cyl. w/5° Head
**Wickman Microform (optional) Like New
**180 Sheffield, Multiform (1957) Like New

GRINDERS, INT.
**1100 Bryant Internal 8" Str. 9. swing Excel
**1316R Bryant Hole Face & Int. 28 Spdl (1952)
*109 Bryant Int. New Spdl. (1947) RBG
*72A3 Heald TR Mod. & Sizematic Mod.
*16-16 Bryant Chucking 1600 RPM
**#172 Heald 36" Swg. 36" Str. '45 & '50

GRINDERS, SURFACE
**8 x 24 Brown & Sharpe Hydr S/N 654 Excel
*12 x 36 Mattison, Hydr. Dresser
*12 x 36 G & L Hydr. Crush Grind Attch. 15 HP
*36" Hanchett #36 Rotary, 30 HP
*16"—#11 Blanchard Vert Rotary RBG
**#240—30" Besley Dbl. Opposed w/Ferris wheel

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*18 x 110 L & S w/TA, Chucks etc.
*30" x 48" Monarch Mod CM, Ser. #16326
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*24 x 96 LeBlond H.D., T. Att. Chuck (1942)
*30 x 96 Niles "Timesaver" T.A. 3J, 4J RBG
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*45x80" Sidney (raised) 360 RPM, 2 carriages (1949)

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**#3 W&S w/Hydr. Barfeed & Tool'g RCG
*#4 Gisholt Univ. H Ways 2½" Cap
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**#5 Gisholt Univ. H. Ways 3" Hole
*#5 W&S w/Barfeed, Pressl RBG
**#5 Gisholt Univ w/Chucking (1950's) RCG
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**3A W&S with Access. 1952 & 1943
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*36x36" Monarch H.D. w/Keller Tracer

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*#4 K&T Univ Horiz 13x74 Tbl. 10 HP RBG
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**#4 Cine H.S. DT., 18x80 Tbl, 15 HP (1951)
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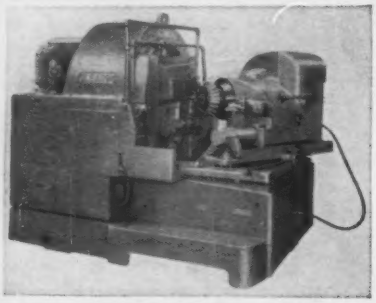

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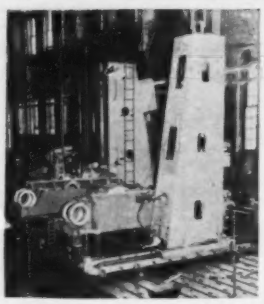

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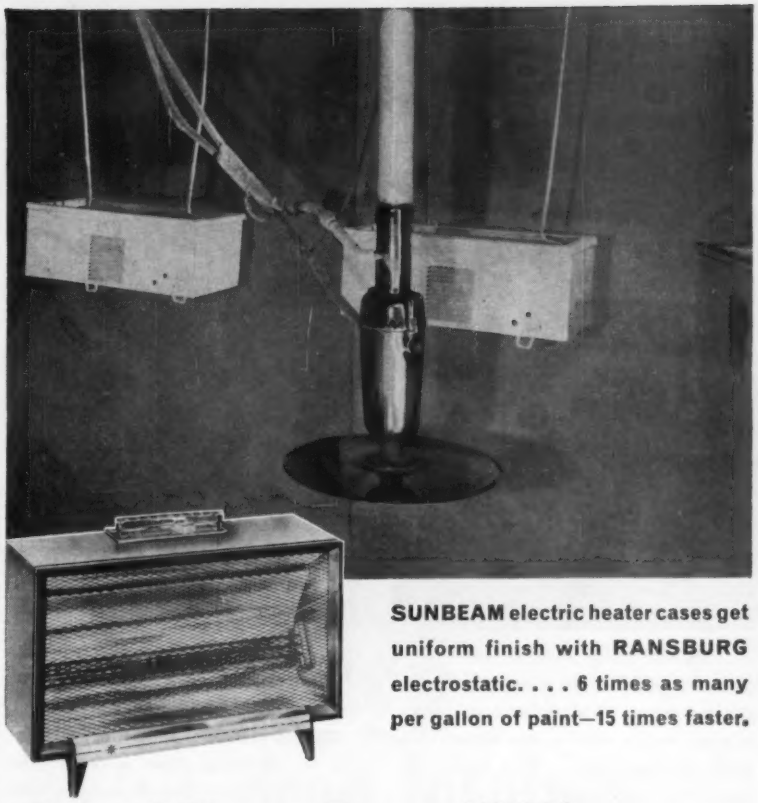

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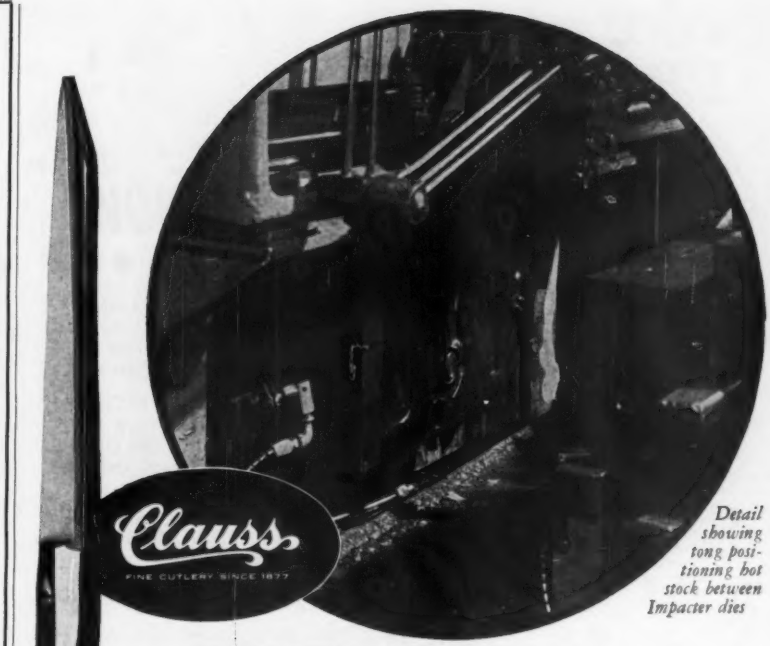

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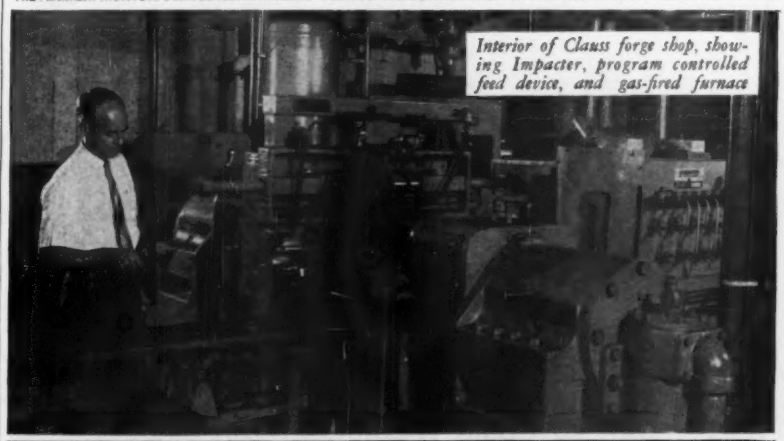

Interior of Clauss forge shop, showing Impacter, program controlled feed device, and gas-fired furnace

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ETCO MACHINES
Handle All Makes of Eyelets, Tubular Rivets and Electronic Terminals

Tubular Riveter
Model 600

Give Yourself Complete Freedom in Fastener Choice

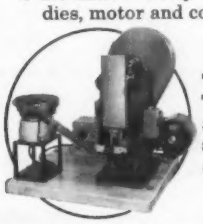
Select the fastener that does your assembly job best. Eyelet Tool Company manufactures machines to handle all makes of tubular rivets, eyelets and electronic terminals.

Let us solve your fastening problem. We will examine your fastener and work-piece and design tracks and dies to solve your problem.

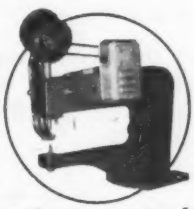
For 100 years the Eyelet Tool Company has specialized in the manufacture of tools for all types of fasteners.

Check These Features

- Circuit design prevents damaging double strokes.
- Setting force in excess of 3,000 ft.-lbs.
- Separate hopper agitator motor insures continuous feed.
- Easy to change tracks for fasteners of different sizes.
- Single revolution clutch engages flywheel.
- Electric foot switch control.
- Safety overload switch protects motor.
- Throat depths up to 10½".
- No extras to buy – Unit is quoted complete with tracks, dies, motor and controls.



Turret Terminal Riveter Model 900
Turret terminal riveter for electrical and electronic industries. Inserts and sets all makes of electronic terminals and base pins.



Eyeletting Machine Model AE-101
Lower cost general purpose eyeletting machines for smaller eyelets. Electric, air or foot operated models available. All have 10½" throat.

Write for descriptive literature and specifications or send samples of fasteners and assembly to:

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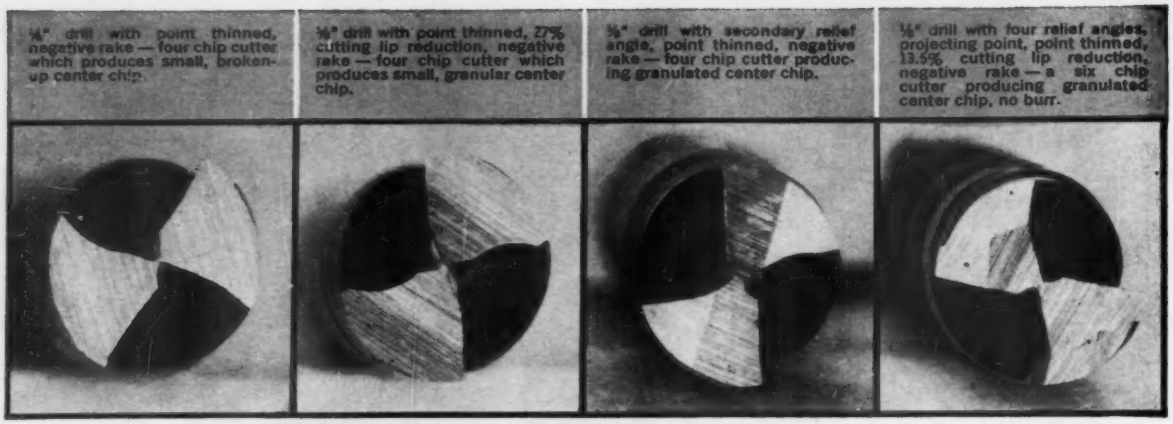

⅛" drill with point thinned, negative rake — four chip cutter which produces small, broken-up center chip.
⅛" drill with point thinned, 27% cutting lip reduction, negative rake — four chip cutter which produces small, granular center chip.
⅛" drill with secondary relief angle, point thinned, negative rake — four chip cutter producing granulated center chip.
⅛" drill with four relief angles, projecting point, point thinned, 13.5% cutting lip reduction, negative rake — a six chip cutter producing granulated center chip, no burr.

only DrillPointMaster gives you this precise control of point geometry

LELAND-GIFFORD'S new DrillPointMaster will sharpen, relieve and thin any drill from #80 to .250″ diameter . . . lets you produce the ideal point geometry for any drilling job — then duplicate that point precisely time after time.

Check the many exclusive features listed at the right, then add these extra benefits:

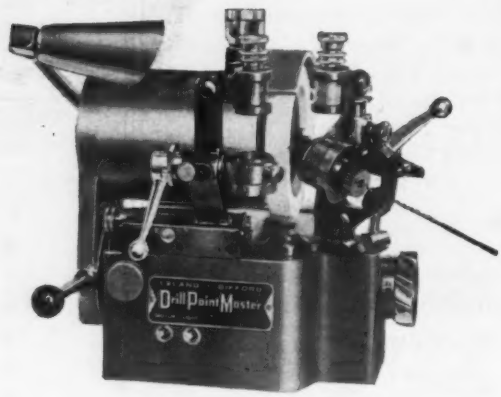
Removes only .003″ to .005″ in renewing point. Normal practice requires .030″ or more, wasting up to 90% of useful length.

Grinds at right angles to cutting edge. Conventional grinders leave grit marks parallel to lip which quickly break down, dull the tool, generate excessive heat.

Drills are centered and located by means of precision collet chuck and microscope viewers. All other methods perpetuate errors resulting from lip wear or inaccuracies in the drill.

Will grind *left hand drills* and, with a diamond wheel, does an excellent job on *carbide drills*.

Get the whole story on the Leland-Gifford DrillPointMaster. Write, wire or phone for an in-plant demonstration — or for complete information.



FEATURES

- Point angle adjustment set from 60° to 180° included angle.
- Lip relief adjustment from 0° to 26°.
- Wheel slide and point thinning carrier micrometer adjusted.
- One collet chuck serves both sharpening and thinning positions.
- Only a few collets needed for all drill sizes.
- Special sandwich wheel for clean, dry grinding and thinning without burning.
- Two variable power microscope viewers plus sealed beam light for precise setting and inspection.

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How many employees in your plant?

1 ☐ Under 20
3 ☐ 20-49
4 ☐ 50-99
5 ☐ 100-249
6 ☐ 250-499
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8 ☐ 1000 and Over

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AM/MM

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CIRCLE 252 READER SERVICE CARD

Umbrella maker gets 40% savings from Graph-Air®

Their umbrellas are easy to raise and sell, but Newark Umbrella Frame Co. had troubles holding their tool costs down. The high-carbon, high-chromium tool steels used to form the ribs and to stamp the catches didn't machine easily. Rolls and punches made of these steels wore out prematurely. Punches often chipped and broke.

Timken Company metallurgists studied the problem. Recommendation: switch to Graph-Air® tool steel. Results: roll life went up 40%; punch life tripled. Here's why.

Forming roll life upped 40% with Graph-Air tool steel.

Graph-Air tool steel triples life of this punch.

Graph-Air machines easier than other tool steels because of the free graphite in its structure. It outwears other tool steels by as much as *3 to 1* because of the uniformly hard carbides in its structure. It air-hardens at 1450°—as much as 450° *below* most other air-hardening tool steels, reducing dimensional change, simplifying heat treating. And Graph-Air holds its accuracy longer because it's one of the Timken graphitic tool steels, the most stable made.

Let Timken Company metallurgists help solve your steel problems. They've been solving tough ones for over 40 years. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

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